Intermountain Generating Station
Unit 2 Capital Modifications
Turnover Package 3/12/04

The enclosed information has been prepared for the Operations Department in preparation for turnover and startup of the major capital modifications installed during the Unit 2, 2004 Spring Outage ending March 26, 2004. The major projects involved here are those that Operations has not yet been provided either adequate training or documentation:

1. Steam Generator Burner Replacement
2. Flame Scanner System Replacement
3. Secondary Air Heater Rotor Rehab
4. ID Fan Variable Speed Drive Replacement
5. Scrubber Forced Oxidation System

Project Schedule

Projects 1 & 2 listed above are currently scheduled for completion on Unit 2 only. Experience with the new, Unit 2 combustion/scanner systems as well as Unit 1 system reliability will bear heavily on future Unit 1 system modifications.

Projects 3 thru 5 above are scheduled for completion on Unit 1 within the next 12 months. Operational experience and feedback on the Unit 2 phase of these projects is especially encouraged in order to optimize the Unit 1 installations next year.

Training

Training classes tailored for Operations have been or are being provided for each of the listed projects. If additional sessions are required please contact Engineering Services. The approximate schedule for presentation of training classes are as follows:

| | |
|---|---|
| Steam Generator Burners: | Sessions began 3/9/04 will continue as requested. |
| Flame Scanner System: | Scheduled for multiple sessions following startup. |
| Secondary Air Heater Rehab: | Sessions began 3/8/04 will continue as requested. |
| ID Fan Variable Speed Drive: | One week of classes scheduled following outage. |
| Scrubber Forced Oxidation: | Scrubber oxidation chemistry classes completed. Specific blower system classes will be provided within the next 30 days. |

We would appreciate feedback of any concerns or suggestions that may arise as these systems are operated. Further information on any aspect of these projects is available by contacting X6464, J. Nelson.

| IPP PROPOSED MODIFICATION PROJECTS | | |
|---|---|---|
| Project | Description | Scheduled Start |
| HP Turbine Retrofit | Replacement of the existing HP turbine sections with advanced technology design | March 2002 - Unit 2<br>March 2003 - Unit 1 |
| Cooling Tower Renovation | Performance modifications to towers for improvements in heat rate and to support potential increases in output. | March 2003 - Unit 1<br>March 2004 - Unit 2 |
| Distributed Control System Replacement | Replacement of increasingly obsolete hybrid control system with newer, more efficient technology. | March 2002 - Unit 2<br>March 2003 - Unit 1 |
| Generator Rewind | Replacement of stator components to address existing grounding concerns. | March 2006 - Unit 2<br>March 2007 - Unit 1 |
| Scrubber Module Rehabilitation | Restoration of corroded surfaces and replacement of degraded module fill. | March 2002<br>(Both units) |
| Burner Replacement | Replacement of Unit burner assemblies | March 2004 -<br>Unit 2 Only |
| Scrubber Wall Ring Efficiency Upgrade | Addition of latest technology module efficiency improvement hardware | Jan 2002 |
| ID Fan Drives | Sequential replacement of hybrid, induced draft fan variable speed drives. | March 2003 |
| NOx Reduction System | Mandated system for reduction of NOx emissions. | March 2006 |

Items for Coordinating Committee

HP Turbine Replacement

Fabrication of the high performance, HP turbine section is proceeding slightly ahead of schedule. Several aspects of design and fabrication are being reported as complete, in our weekly updates. The following among those items:

- Inner casing casting drawing
- Diaphragm bar sizing
- Rotating blade bar sizing
- Inner shell bolting drawings

The first of two quality assurance reviews will occur at the factory beginning May 16. Verification of progress to-date, upcoming milestones, casting berth preparations and material inspections will occur at this 'design review' meeting. Discussions regarding on-site preparations to receive, store and install the HP section have also begun.

Scrubber Module Cladding

Repair of the inlet sections of the scrubber absorber modules is nearly complete. The final module (Unit 1B) is currently midway to completion. On-site construction is scheduled to be finished before the end of May. With the completion of this contract, the most severely corroded areas of the absorber, near the inlet, will be corrected with a corrosion resistant alloy inner cladding and exterior epoxy coatings.

The next phase of budgeted scrubber rehabilitation is scheduled to begin this fall. Specifications high efficiency improved mist eliminators and flow directors have been completed and issued for bid. Specifications for correction of general structural corrosion are nearing completion. Construction under these specifications is schedule to begin in fall of 2001.

Boiler Evaluation and Testing

A contract for overall boiler evaluation associated with the planned flow uprate at IPSC, has been awarded to Babcock & Wilcox, the original equipment manufacturer. Initial performance testing associated with the evaluation has recently been completed. The evaluation will review many key aspects of design and current performance associated with increasing the rated boiler output from 6.6 Mlbs/hr to 6.9 Mlbs/hr. Some of the key issues to be reviewed include:

- Furnace Circulation Capacity
- BTU Input Limitations
- Safety Valve Requirements and Reliability
- Current NOx technology and associated hardware.
- Outlet Temperature Control and Stability
- Fan Requirements
- Fuel Preparation Provisions and Limitations
- Boiler Metal Temperature Evaluation

The study is scheduled for completion over 12 weeks. The study is timed to allow for fabrication and installation of recommended design alterations where necessary, during the upcoming 2002, Unit 2 Outage.

## Boiler Uprate Modifications

The draft final report from the boiler manufacturer has been received. Final recommendations are as previously described. They consist of:

- Addition of one main steam safety valve
- Installation of an additional bank of primary superheat tube
- Minor modifications to the steam drum to accommodate the increased flow

Specifications have been developed for purchase of the requisite safety relief valve to be installed during the upcoming Unit 2 outage. The additional bank of primary superheat surface has been included in the preliminary budget for next (2002-2003).

With the modifications noted above, the study report states that the IGS boilers should operate reliably at the new maximum continuous flow rate of 6.9 million lbs/hr.

## HP Turbine Upgrade

The new high pressure turbine section is now in final machining an assembly. The turbine is scheduled to ship to IGS during the third week of January. Materials for the Unit 1 turbine to be delivered in December of 2002, are now being purchased.

The final contracts for changeout of the high pressure turbine have recently been awarded. These include technical direction services and laser alignment services. The project is currently on schedule and budget.

## Scrubber Rehab Project

Contract award recommendations have been issued for the construction contractor and cladding material supply. All material specifications and requisitions have been issued and are now beginning to be delivered. The first third of the mist eliminators, a major component in the absorber rebuild, have been received IGS.

Contractor mobilization is scheduled to begin by the end of November. Low bid for construction services on this project have come back at just over $3 million. The engineering estimate was $4.2 million. The evaluated low bidder is the most experienced cladding contractor in the US, Rocky Mountain Fabrication. The cladding material bid was approximately $100,000 below the engineering estimate of $1.3 million

# MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George Cross

FROM: Dennis Killian

DATE: March 23, 2002

SUBJECT: Current Modifications at IGS

The purpose of this memo is to provide current information on the larger modifications presently underway at IGS, and the associated operational impacts.

Projects included are:

- HP Turbine Retrofit
- Helper Tower
- Boiler Feed Pump Upgrade
- Boiler Safety Valve Modifications
- Sootblower Piping System Redesign
- HP Heater Drain Piping Reroute
- Isophase Cooling System
- Cooling Tower Makeup Upgrade
- Pulverizer Rejects System Upgrade
- Absorber Vessel Upgrade

HP Turbine

The operational impacts of the High Pressure Turbine Section Retrofit were recently discussed in two sessions with all Unit Operators, Control Operators, Operations Supervisors and Assistant Superintendent of Operations. A package of information covering anticipated operational impacts was distributed to each individual.

The exact effect of full arc (FA) operation on startup time will only be known after startup of Unit 2. However, it is generally acknowledged that startup times will be longer to some degree. The partial arc selector will be removed from the Unit 2 control panel.

Other operational differences discussed include a slightly higher load index pressure and the addition of top/bottom shell temperature sensors. The load index pressure on Unit 2 has been moved upstream to the main steam line from the previous 1$^{st}$ stage location. This will result in an incrementally higher pressure displayed on what has always been the 1$^{st}$ stage pressure display on the control panel. Also, Alstom has encouraged IPSC to install top and bottom thermocouples at the mid point of the outer shell on the HP section. These temperatures will be displayed in the Information Computer on the Bentley-Nevada turbine vibration screen.

Helper Cooling Tower

A helper cooling tower is currently scheduled for installation within the coming 12 months. Foundation analysis and survey work has already begun.

The helper tower is a 'linear' design consisting of two, four-cell towers constructed end to end. The tower will be constructed along the east side of the existing cooling towers.

The design calls for approximately 20% of the existing flow to be re-routed from the current circ water return line to the new tower. As part of this upgrade the circulating water pump impellers are scheduled to be upgraded to provide at least 10% flow improvement at current head requirements. With this impeller upgrade the pumps will be designed to provide the required head and flow at 1.0 service factor horsepower. The motor has a 1.15 service factor rating.

The helper tower has been sized to provide approximately twice the heat rejection capability increment required for the scheduled uprate in order to assist with back pressure concerns during the hottest months.

An evaluation for maximizing output of the existing towers is currently underway. We are hoping to regain 5-10% of the existing tower capability to add to the total cooling capacity.

Boiler Feed Pump Upgrade

Along with the recent uprate of the high speed stop on the boiler feed pumps to 6000rpm, the boiler feed pumps are also scheduled for a hardware upgrade. The upgrade consists of replacing all four existing, 5-vane impellers with 7-vane style impellers and smoothing the flow path within the pump.

The available test data associated with the pump upgrade claims to provide an approximate 5% improvement in pump performance. With this upgrade, the pumps are expected to operate at approximately the same rpm following the uprate as before. This will allow us to maintain the additional operating margin achieved by the 6000rpm high speed stop uprate.

Boiler Safety-Relief Valve Modifications

With the uprate modifications, the boiler will receive a new MCR flow rating of 6.9 MMLBS/hr. In support of this new capability, the boiler safety relief valves are being modified to maintain the same level of redundancy at the uprated conditions as now exists.

The relief valve uprate consists of modifying one of the two existing electromatic relief valves to a spring actuated valve. This is done to allow this valve to become part of the code relief capability for the boiler.

Several of the existing hot and cold reheat safety relief valves will receive new rated springs. These springs will allow for increased relief pressure settings as required for the new boiler flow rating.

Sootblower Piping Redesign

As a result of recent piping failures at the sootblower pressure controller on the 18th floor, design changes are underway on the associated piping and controllers. Changes will include modifications to the piping restraint system and ACV controller.

The piping modifications have been prepared by CEntry Engineers with the help of a dynamic loading model. This model allows us to impose the forces causing the previous failures and to make effective corrections to the design. This change will eliminate the safety concerns associated with previous sootblower piping ruptures. These modifications are being completed on both units at the present time.

Additionally, the associated pressure controller will now close on loss of pressure signal. Efforts are underway to relocate this controller down to the control room. This will remove the controller to a less severe environment and provide direct access for operators to take corrective control action.

HP Heater Drain Piping

For several years, concerns have increased regarding the structural adequacy of the HP heater drain line in the area of the deaerator. This modification, now implemented on Unit 2, reroutes the line and relocates the pressure control valve.

The design intent is to reduce the propensity of the drain flow to flash prior to the flash tank, This will reduce the forces causing the excessive deflection and stress now occurring in the associated drain line.

Isophase Cooling System

The generator isophase enclosure has run increasingly hotter through the years as unit uprates have occurred. Corrections have been made at the braid connections and at the ground conductors in an effort to minimize component temperatures. Enclosure temperatures have been running close to 100°C(210°F).

A study conducted by Delta Unibus concluded that the temperature was being generated within the enclosure skin itself by virtue of the large recirculating current induced on the enclosure from the conductors. To correct the problem, a forced air cooling system has been installed on Unit 2 which feeds ambient air into the isophase enclosure and vents it near the generator breakers.

The fan is designed for maximum reliability with an installed, spare motor that can be put into service with the installation of a drive belt. Spare bearings are also being purchased for immediate installation should that become necessary. This system will alarm to the Rochester annunciator should the breaker be closed and the forced cooling system not running.

Cooling Tower Makeup Upgrade

For several years the cooling tower makeup system has been one of the weak links in the heat rejection system. The uprate provided an excellent opportunity to correct this problem. The makeup systems are being retrofitted with a larger (250 hp) motor running at 1200 rpm. This, along with an upsizing of the control valve bypass to main line size (20"), is designed to provide ample makeup for the expanded circulating water system.

The new motors will be installed with variable speed drives to allow for more efficient and effective control of the makeup system.

Pulverizer Rejects System Upgrade

With historical unit uprates and diminishing coal quality the pulverizer reject system has become increasingly inadequate. The modifications currently underway are designed to address both system operational reliability and maintainability.

The focus of these modifications is the upsizing and relocation of the reject system ejector pumps. The pumps are now placed in a location to allow for direct access for clearing obstructions and are able to empty the rejects hoppers in less time.

We are currently evaluating options to improve the reliability of the reject system auto initiation instrumentation with the intent of reducing further the degree of attention required from the bottom ash operator.

There will always be varying amounts of attention required by bottom ash operators due the variations coal quality, status of mill internals and air flow system reliability. However, this is a critical first step in addressing the larger issues of mill reliability, especially at higher load.

There has recently been concerns regarding backfilling of the pulverizer windbox associated with these reject system modifications. We are investigating this issue at the present time.

Associated with this issue are concerns regarding the reliability and adequacy of the ash recycle water supply system and bottom ash feed and transfer pumps. This issue is also a critical piece of overall system reliability and is currently being assessed.

Scrubber Forced Oxidation System

Estimates are now in hand for developing the design and procurement specifications for adding a forced oxidation system to both unit scrubber systems. A package for awarding the design of this system is being prepared for staff approval at the present time.

In recent years our scrubber chemistry has become increasingly unacceptable. We have gone from essentially complete oxidation at 840 MW to substantially sulfite chemistry at 875. Expectations are that 950MW will make the situation proportionateley worse.

Recent testing has shown that overall reaction tank oxidation is down by at least 30% compared to acceptance testing. Particle sizing and liquor density in the reaction tanks varies by nearly 100% from the top of the reaction tank, where the effluent is taken, to the bottom of the tank.

The design intent of the oxidation system will be to return the reaction tank to a fully oxidized, sulfate chemistry. This will provide for proper clarification and de-watering of the effluent and will substantially address the growing pond volume and sedimentation concerns.

Absorber Vessel Upgrade

The ongoing modifications in all absorber vessels is scheduled to be completed in mid 2004. As an extension of earlier modifications made at the inlet shelves of the absorber modules and seal skirts, work is currently underway on:

- Cladding the remaining, upper part of the module
- Replacing the fiberglass mist eliminators and support system

with a more efficient design

- Adding a baffle system around the periphery of the absorber modules to improve module effectiveness.

Additionally, the reaction tank fiberglass roof sections are being replaced with coated steel and an improved coating system is being installed on the reaction tank floors.

Ash Recycle Ph Control System

The design package will soon be complete for installation of a new ash recycle pump discharge acid addition system. The design that will be proposed to staff shows the system located at the ash recycle pump enclosure near the ash recycle pond.

This system will maintain adequately low Ph in the recycle water to address the significant scaling concerns throughout the bottom ash system. One of the worst impacts of the historical scaling problems is bottom ash hopper drain plugging. This causes concerns with both material transfer and waterwall quenching.

The acid addition system will include an 8700 gallon tank of Sulfuric Acid supplying two of three injection pumps. The pumps will inject a controlled flow of diluted acid upstream of the existing ash recycle pumps. A Ph sensor and controller downstream will maintain proper acid flow to achieve a Ph of approximately 7.8 in the recycled ash water.

# MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George W. Cross

FROM: Dennis K. Killian

DATE: March 26, 2002

SUBJECT: Current Modifications at IGS

The purpose of this memo is to provide current information on the larger modifications presently underway at IGS, and the associated operational impacts. Final staff approval has not been received on all listed projects.

Projects included are:
- HP Turbine Retrofit
- Helper Tower
- Boiler Feed Pump Upgrade
- Boiler Safety Valve Modifications
- Sootblower Piping System Redesign
- HP Heater Drain Piping Reroute
- Isophase Cooling System
- Cooling Tower Makeup Upgrade
- Pulverizer Rejects System Upgrade
- Scrubber Forced Oxidation System
- Absorber Vessel Upgrade
- Ash Recycle pH Control System

<u>HP Turbine</u>
The operational impacts of the High Pressure Turbine Section Retrofit were recently discussed in two sessions with all Unit Operators, Control Operators, Operations Supervisors, and the Assistant Superintendent of Operations. A package of information covering anticipated operational impacts was distributed to each individual.

The exact effect of full arc (FA) only operation, on startup time, will only be known after startup of Unit 2. However, it is generally acknowledged that startup times will be longer to some degree. The partial arc selector will be removed from the Unit 2 control panel.

Other operational differences discussed include a slightly higher load index pressure and the addition of top/bottom shell temperature sensors. The load index pressure on Unit 2 has been moved upstream to the main steam line from the previous 1st stage location. This will result in an incrementally higher pressure displayed on what has always been the 1st stage pressure display on the control panel. Also, Alstom has encouraged IPSC to install top and bottom thermocouples at the mid point of the outer shell on the HP section. These temperatures will be displayed in the Information Computer on the Bentley-Nevada turbine vibration screen.

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The design calls for approximately 20 percent of the existing flow to be rerouted from the current circ water return line to the new tower. As part of this upgrade the circulating water pump impellers are scheduled to be upgraded to provide at least 10 percent flow improvement at current head requirements. With this impeller upgrade the pumps will be designed to provide the required head and flow at 1.0 service factor horsepower. The motor has a 1.15 service factor rating.

The helper tower has been sized to provide approximately twice the heat rejection capability increment required for the scheduled uprate in order to assist with back pressure concerns during the hottest months.

An evaluation for maximizing output of the existing towers is currently underway. We are hoping to regain 5-10 percent of the existing tower capability to add to the total cooling capacity.

Boiler Feed Pump Upgrade

Along with the recent uprate of the high speed stop on the boiler feed pumps to 6000 rpm, the boiler feed pumps are also scheduled for a hardware upgrade. The upgrade consists of replacing all four existing, 5-vane impellers with 7-vane style impellers and smoothing the flow path within the pump.

The available test data associated with the pump upgrade claims to provide an approximate 5 percent improvement in pump performance. With this upgrade, the pumps are expected to operate at approximately the same rpm following the uprate as before. This will allow us to maintain the additional operating margin achieved by the 6000-rpm high speed stop uprate.

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With the uprate modifications the boiler will receive a new MCR flow rating of 6.9 MMLBS/hr. In support of this new capability, the boiler safety relief valves are being modified to maintain the same level of redundancy at the uprated conditions as now exists.

The relief valve uprate consists of modifying one of the two existing electromatic relief valves to a spring actuated valve. This is done to allow this valve to become part of the code relief capability for the boiler.

Several of the existing hot and cold reheat safety relief valves will receive new rated springs. These springs will allow for increased relief pressure settings as required for the new boiler flow rating.

Sootblower Piping Redesign
As a result of recent piping failures at the sootblower pressure controller on the 18th floor, design changes are underway on the associated piping and controllers. Changes will include modifications to the piping restraint system and ACV controller.

The piping modifications have been prepared by CEntry Engineers with the help of a dynamic loading model. This model allows us to impose the forces causing the previous failures and to make effective corrections to the design. This change will eliminate the safety concerns associated with previous sootblower piping ruptures. These modifications are being completed on both units at the present time.

Additionally, the associated pressure controller will now close on loss of pressure signal. Efforts are underway to relocate this controller down to the control room. This will remove the controller to a less severe environment and provide direct access for operators to take corrective control action.

HP Heater Drain Piping
For several years, concerns have increased regarding the structural adequacy of the HP heater drain line in the area of the deaerator. This modification, now implemented on Unit 2, reroutes the line and relocates the pressure control valve.

The design intent is to reduce the propensity of the drain flow to flash prior to the flash tank. This will reduce the forces causing the excessive deflection and stress now occurring in the associated drain line.

Isophase Cooling System
The generator isophase enclosure has run increasingly hotter

through the years as unit uprates have occurred. Corrections have been made at the braid connections and at the ground conductors in an effort to minimize component temperatures. Enclosure temperatures have been running close to 100°C(210°F).

A study conducted by Delta Unibus concluded that the temperature was being generated within the enclosure skin itself by virtue of the large amperage being conducted to ground associated with the typical imbalance voltage. As a result, a forced cooling system has been installed on Unit 2 feeding ambient air into the isophase enclosure which will be vented at near the generator breakers.

The fan is designed for maximum reliability with an installed, spare motor that can be put into service with the installation of a drive belt. Spare bearings are also being purchased for immediate installation should that become necessary. This system will alarm to the Rochester annunciator should the breaker be closed and the forced cooling system not running.

Cooling Tower Makeup Upgrade

For several years the cooling tower makeup system has been one of the weak links in the heat rejection system. The uprate provided an excellent opportunity to correct this problem. The makeup systems are being retrofitted with a larger (250 hp) motor running at 1200 rpm. This, along with an upsizing of the control valve bypass to main line size (20"), is designed to provide ample makeup for the expanded circulating water system.

The new motors will be installed with variable speed drives to allow for more efficient and effective control of the makeup system.

Pulverizer Rejects System Upgrade

With historical unit uprates and diminishing coal quality the pulverizer reject system has become increasingly inadequate. The modifications currently underway are designed to address both system operational reliability and maintainability.

The focus of these modifications is the upsizing and relocation of the reject system ejector pumps. The pumps are now placed in a location to allow for direct access for clearing obstructions and are able to empty the rejects hoppers in less time.

We are currently evaluating options to improve the reliability of the reject system auto initiation instrumentation with the intent of reducing further the degree of attention required from the bottom ash operator.

There will always be varying amounts of attention required by bottom ash operators due to the variations coal quality, status of mill internals and air flow system reliability. However, this is a critical first step in addressing the larger issues of mill reliability, especially at higher load.

There have recently been concerns regarding backfilling of the pulverizer windbox associated with these reject system modifications. We are investigating this issue at the present time.

Associated with this issue are concerns regarding the reliability and adequacy of the ash recycle water supply system and bottom ash feed and transfer pumps. This issue is also a critical piece of overall system reliability and is currently being assessed.

Scrubber Forced Oxidation System
Estimates are now in hand for developing the design and procurement specifications for adding a forced oxidation system to both unit scrubber systems. A package for awarding the design of this system is being prepared for staff approval at the present time.

In recent years our scrubber chemistry has become increasingly unacceptable. We have gone from essentially complete oxidation at 840 MW to substantially sulfite chemistry at 875. Expectations are that 950MW will make the situation proportionateley worse.

Recent testing has shown that overall reaction tank oxidation is down by at least 30 percent compared to acceptance testing. Particle sizing and liquor density in the reaction tanks varies by nearly 100 percent from the top of the reaction tank, where the effluent is taken, to the bottom of the tank.

The design intent of the oxidation system will be to return the reaction tank to a fully oxidized, sulfate chemistry. This will provide for proper clarification and de-watering of the effluent and will substantially address the growing pond volume and sedimentation concerns.

Absorber Vessel Upgrade
The ongoing modifications in all absorber vessels is scheduled to be completed in mid 2004. As an extension of earlier modifications made at the inlet shelves of the absorber modules and seal skirts, work is currently underway on:

- Cladding the remaining, upper part of the module
- Replacing the fiberglass mist eliminators and support system with a more efficient design
- Adding a baffle system around the periphery of the absorber modules to improve module effectiveness.

Additionally, the reaction tank fiberglass roof sections are being replaced with coated steel and an improved coating system is being installed on the reaction tank floors.

Ash Recycle pH Control System
The design package will soon be complete for installation of a new ash recycle pump discharge acid addition system. The design that will be proposed to staff shows the system located at the ash recycle pump enclosure near the ash recycle pond.

This system will maintain adequately low pH in the recycle water to address the significant scaling concerns throughout the bottom ash system. One of the worst impacts of the historical scaling problems is bottom ash hopper drain plugging. This causes concerns with both material transfer and waterwall quenching.

The acid addition system will include an 8700-gallon tank of Sulfuric Acid supplying two of three injection pumps. The pumps will inject a controlled flow of diluted acid upstream of the existing ash recycle pumps. A pH sensor and controller downstream will maintain proper acid flow to achieve a pH of approximately 7.8 in the recycled ash water.

JN/JKH:jmg

**MEMORANDUM**

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: Joe D. Hamblin



FROM: Dennis K. Killian

DATE: March 26, 2002

SUBJECT: Modifications Completed During the Spring Outage on Unit 2

The purpose of this memo is to provide an overview and some operating information on the projects and modifications completed during this outage. The major projects have had or will have detailed operating instructions prepared in addition to this memo. After this outage, Unit 2 should operate at approximately 895-900 MWGross with approximately the same steam and fuel flow as before the outage.

Projects completed this spring on Unit 2 are:

- HP Turbine Retrofit
- Boiler Feed Pump Upgrade BFP 1B
- Boiler Safety Valve Modifications
- Sootblower Piping System Redesign
- HP Heater Drain Piping Reroute
- Isophase Bus Duct Cooling System
- Cooling Tower Makeup Upgrade
- Pulverizer Rejects System Upgrade
- Absorber Vessel Upgrade

**HP Turbine (IGS01-02)**

The operational impacts of the High Pressure Turbine Section Retrofit were recently discussed in two sessions with all Unit Operators, Control Operators, Operations Supervisors, and the Assistant Superintendents of Operations. A package of information covering anticipated operational impacts was distributed to each individual.

The exact effect of full arc (FA) operation on startup time will only be known after startup of Unit 2. However, it is generally acknowledged that startup times will be longer to some degree. The partial arc selector will be removed from the Unit 2 control panel.

Other operational differences discussed include a slightly higher load index pressure and the addition of top/bottom shell temperature sensors. The load index pressure on Unit 2 has been moved upstream to the main steam line from the previous 1st stage location. This will result in an incrementally higher pressure displayed on what has always been the 1st stage pressure display on the control panel. At Alstom's request, we have also installed top and bottom thermocouples at the mid point of the outer shell of the HP section. These temperatures will be displayed on the PI Information Computer on the Bentley-Nevada turbine vibration screen.

**Boiler Feed Pump Upgrade (IGS01-23)**
Along with the recent uprate of the high speed stop on the boiler feed pumps to 6000 rpm, the boiler feed pumps are also scheduled for a hardware upgrade. The upgrade consists of replacing all four existing, 5-vane impellers with 7-vane style impellers and smoothing the flow path within the pump. This modification was completed on Unit 2 Boiler Feed Pump 1B during this outage. The other pumps on both units will be completed during future outages if BFP 1B is successful.

This modification should improve pump performance by approximately 5 percent. With this upgrade, the pumps are expected to operate at approximately the same rpm as before, following the uprate. This will allow us to maintain the additional operating margin achieved by the 6000-rpm high speed stop uprate.

**Boiler Safety-Relief Valve Modifications (IGS01-18)**
With the uprate modifications, the boiler will receive a new MCR flow rating of 6.9 MMLBS/hr. In support of this new capability, the boiler safety relief valves were modified to maintain the same level of redundancy at the uprated conditions as now exists.

During this outage, electromatic relief valve 2SGG-ERV-03 was removed from service and replaced with a 2.5 inch spring actuated relief valve with a set pressure of 2855 PSI. This was done so this valve could become part of the code relief capability for the boiler. The other main steam safety valves were also changed to the following new set pressures.

| **Valve** | **Old Set Pressure** | **New Set Pressure** |
|---|---|---|
| 2SGG-RV-4 (New Valve) | NA | 2855 |
| 2SGG-RV-5 | 2815 | 2835 |
| 2SGG-RV-6 | 2800 | 2815 |
| 2SGG-RV-7 | 2785 | 2795 |
| 2SGG-RV-8 | 2775 | 2775 |

In addition to the new safety valve, several of the existing hot and cold reheat safety relief valves will receive new springs that will raise their set pressure and increase their relieving capacity.

| **Valve** | **Old Set Pressure** | **New Set Pressure** |
|---|---|---|
| 2SGJ-RV-1 | 681 | 750 |
| 2SGJ-RV-2 | 681 | 750 |
| 2SGJ-RV-3 | 692 | 755 |
| 2SGJ-RV-4 | 692 | 755 |
| 2SGJ-RV-5 | 700 | 760 |
| 2SGJ-RV-6 | 700 | 760 |
| 2SGJ-RV-7 | 705 | 770 |
| 2SGJ-RV-8 | 705 | 770 |
| 2SGJ-RV-9 | 630 | 698 |
| 2SGJ-RV-10 | 630 | 698 |
| 2SGJ-RV-11 | 640 | 720 |
| 2SGJ-RV-12 | 640 | 720 |



**HP Heater Drain Piping (IGS01-24)**

For several years, concerns have increased regarding the structural adequacy of the HP heater drain line in the area of the deaerator. This modification, now implemented on Unit 2, reroutes the line and relocates the pressure control valve to the flash tank. The design intent is to reduce the propensity of the drain flow to flash prior to the flash tank. This will reduce the forces causing the excessive vibration and stress now occurring in the associated drain line.

**Isophase Cooling System (IGS01-21)**

The generator isophase enclosure has run increasingly hotter through the years as unit uprates have occurred. Corrections have been made at the braid connections and at the ground conductors in an effort to minimize component temperatures. Enclosure temperatures have been running close to 100°C (210°F).

A study conducted by Delta Unibus concluded that the temperature was being generated within the enclosure skin itself by virtue of the large recirculating current induced on the enclosure from the conductors. To correct the problem, a forced air cooling system has been installed on Unit 2 which feeds ambient air into the isophase enclosure and vents it near the generator breakers.

The fan is designed for maximum reliability with an installed spare motor that can be put into service with the installation of a drive belt. Spare bearings are also being purchased for immediate installation should that become necessary.

The fan will automatically start when the generator breaker is closed and will stop when it reopens. This system will alarm to the Rochester annunciator should the breaker be closed and the forced cooling system not be running.

**Cooling Tower Makeup Upgrade (IGS01-06)**

For several years, we have had a hard time maintaining level in the cooling tower basins during the hottest parts of the summer. The uprate provided an excellent opportunity to correct this problem. During the outage, the control valve bypass line was increased to the same size as the main line (20 inches). This will reduce the back pressure on the line and increase flow. In the future, the circ water make-up pumps will be retrofitted with a larger (250 hp) motor running at 1200 rpm. The new motors will be installed with variable speed drives to allow for more efficient and effective control of the makeup system.

**Sootblower Piping Redesign**

As a result of recent piping failures at the sootblower pressure controller on the 18th floor, design changes are underway on the associated piping and controllers. Changes will include modifications to the piping restraint system and ACV controller.

The piping modifications have been prepared by CEntry Engineers with the help of a dynamic loading model. This model allows us to impose the forces causing the previous failures and to make effective corrections to the design. This change will eliminate the safety concerns associated with previous sootblower piping ruptures. These modifications are being completed on both units at the present time.

Additionally, the associated pressure controller will now close on loss of pressure signal. Efforts are underway to relocate this controller down to the control room. This will remove the controller to a less severe environment and provide direct access for operators to take corrective control action.

**Pulverizer Rejects System Upgrade (IGS00-11)**

With unit uprates and diminishing coal quality, the pulverizer reject system has become increasingly inadequate. The modifications currently underway are designed to address both system operational reliability and maintainability.

The focus of these modifications is the upsizing and relocation of the reject system ejector pumps. The pumps are now placed in a location to allow for direct access for clearing obstructions and are able to empty the rejects hoppers in less time.

We are currently evaluating options to improve the reliability of the reject system auto initiation instrumentation with the intent of reducing further the degree of attention required from the bottom ash operator.

There will always be varying amounts of attention required by bottom ash operators due to the variations in coal quality, status of mill internals and air flow system reliability. However, this is a critical first step in addressing the larger issues of mill reliability, especially at higher load.

There have recently been concerns regarding backfilling of the pulverizer windbox associated with these reject system modifications. We are investigating this issue at the present time.

Associated with this issue are concerns regarding the reliability and adequacy of the ash recycle water supply system and bottom ash feed and transfer pumps. This issue is also a critical piece of overall system reliability and is currently being assessed.

The following projects are not yet completed but, are scheduled for completion in the next two years. They are included in this memo for your information.

**Scrubber Forced Oxidation System IGS02-12**

Estimates are now in hand for developing the design and procurement specifications for adding a forced oxidation system to both unit scrubber systems. A package for awarding the design of this system is being prepared for staff approval at the present time.

In recent years our scrubber chemistry has become increasingly unacceptable. We have gone from essentially complete oxidation several years ago to substantially calcium sulfite chemistry now. Expectations are that 950 MW load will make the situation worse.

Recent testing has shown that overall reaction tank oxidation is down by at least 30 percent compared to acceptance testing. Particle sizing and liquor density in the reaction tanks varies by nearly 100 percent from the top of the reaction tank, where the effluent is taken, to the bottom of the tank.

The design intent of the oxidation system will be to return the reaction tank to a fully oxidized, calcium sulfate chemistry. This will provide for proper clarification and de-watering of the effluent and will reduce the potential for scaling in the scrubber modules.

**Absorber Vessel Upgrade (IGS01-08)**
The ongoing modifications in all absorber vessels are scheduled to be completed in mid 2004. As an extension of earlier modifications made at the inlet shelves of the absorber modules and seal skirts, work is currently underway on:

- Cladding the remaining, upper part of the module.
- Replacing the fiberglass mist eliminators and support system with a more efficient design.
- Adding a baffle system around the periphery of the absorber modules to improve module effectiveness.

Additionally, the reaction tank fiberglass roof sections are being replaced with coated steel and an improved coating system is being installed on the reaction tank floors.

**Ash Recycle pH Control System (IGS01-05)**
The design package will soon be complete for installation of a new ash recycle pump discharge acid addition system. The design will be located at the ash recycle pump enclosure near the ash recycle pond. This system will maintain adequately low pH in the recycle water to address the scaling concerns throughout the bottom ash system. One of the worst impacts of the scaling problems is bottom ash hopper drain plugging. This causes concerns with both material transfer and waterwall quenching.

The acid addition system will include an 8700-gallon tank of sulfuric acid supplying two of three injection pumps. The pumps will inject a controlled flow of diluted acid upstream of the existing ash recycle pumps. A pH sensor and controller downstream will maintain proper acid flow to achieve a pH of 7.5 to 8.5 in the recycled ash water.

**Helper Cooling Tower (IGS02-02)**
A helper cooling tower is currently scheduled for installation within the coming 12 months. Foundation analysis and survey work has already begun.

The helper tower will be a 'linear' design consisting of two, four-cell towers constructed end to end. The tower will be constructed along the east side of the existing cooling towers. Orange stakes are currently located in the ground in the area outlining the perimeter of the new tower. Approximately 15 percent of the existing circ water flow will be re-routed from the current circ water return line to the new tower. As part of this upgrade the circulating water pump impellers are scheduled to be upgraded to provide at least 10 percent flow improvement at current head requirements. With this impeller upgrade the pumps will be designed to provide the required head and flow at 1.0 service factor horsepower. The motor has a 1.15 service factor rating.

The helper tower has been sized to provide approximately twice the heat rejection capability increment required for the scheduled uprate in order to assist with back pressure concerns during the hottest months.

If you would like further information on these projects, please feel free to contact the engineer responsible for each. The electronic project files for each project can also be viewed through the plant computer network. They are located on N:current\projects by the referenced project name.

JHN/JKH:jmg

cc: Norman Mincer
Aaron Nissen
George Cross
Neil Clay

# IPSC History
## Station Uprate to 950MW

In March of 2004, the last of the station uprate projects were completed and a revised load guide sheet showing a full load rating on each unit of 950MW was approved by LADWP. This uprate represents an 8.57% increase in gross output of the facility. The entire uprate was completed for a cost of approximately $26,000,000. The project will generate estimated additional revenue of over $30,000,000 annually.

The uprate project included several major modifications to core power cycle processes and equipment. Among these are the following:

- Re-design and retrofit of the entire turbine high pressure section
- Re-design and retrofit of the turbine-driven, boiler feed pump volutes and impellers
- Retrofit of an overfire air combustion system to accommodate variations in fuel quality at the higher loads.
- Re-design of an existing boiler safety relief valve station to accommodate the higher boiler steam flow rating flows.
- Retrofit of cooling modifications to the generator step-up transformer
- Installation of a 'helper' cooling tower for maintaining turbine performance on both units
- Re-design and retrofit of high performance circulating water pump impellers

The uprate project was completed on time and for 34% less than the original budget estimate of $35,000,000. In recognition of the significant benefit to the project, the ratepayers and the stockholders, the operating agent, an award was presented to IPSC by the IPSC Coordinating Committee. The award included a cash distribution to all IPSC employees for initiating and completing this uprate in a quality and timely manner.

IGS UPRATE PROJECT COORDINATION

**Yearly Additional Cost Requirements Projection**

| | |
|---|---|
| Current Fiscal Year | |
| Cooling Tower Concrete Repair and Coating | $453,000* |
| | **$453,000** |
| 2001-2002 Fiscal Year | |
| Unit 2 HP Turbine Retrofit - Installation | $5,500,000* |
| Cooling Tower Upgrade Testing and Spec Development | $452,000* |
| Unit 2 Boiler Safety Valve Addition - Installation | $250,000* |
| Unit 1 & 2 Generator Cooling Enhancements - Installation | $200,000 |
| Unit 1 & 2 Isophase Cooling Enhancements - Installation | $200,000 |
| Unit 1 & 2 Large Motor Bus Equalization - Installation | $300,000 |
| Unit 1 & 2ID Fan Suction Duct Evaluation - Installation | $300,000 |
| Unit 2 Boiler Feed Pump Upgrade - Installation | $150,000 |
| Unit 1 & 2 Main Step-up Transformer Cooling - Installation | $200,000 |
| Unit 2 Burner Replacement (Upgrade) - Installation | $2,000,000 |
| Unit 1 & 2 Scrubber Wall Ring - (Installation of approx. half) | $600,000* |
| Unit 1 & 2 Generator Stator Cooling Water O2 System - Installation | $200,000 |
| Unit 1 $ 2 HP Heater Drain Piping Modifications - Installation | $200,000 |
| Unit 2 Boiler Modifications - Installation | $250,000 |
| | **$10,802,000** |
| **(Already in Upcoming Budget)** | **-($6,802,000)** |
| | **$4,000,000** |
| 2002-2003 Fiscal Year | |
| Unit 1 HP Turbine Retrofit - Installation | $4,500,000 |
| Unit 1 Cooling Tower Upgrade - Installation | $4,000,000 |
| Unit 1 Boiler Safety Valve Addition - Installation | $250,000 |
| Unit 1 Boiler Feed Pump Upgrade - Installation | $150,000 |
| Unit 1 Burner Replacement (Upgrade) - Installation | $2,000,000 |
| Unit 1 Boiler Modifications - Installation | $250,000 |
| | **$11,150,000** |
| 2003-2004 Fiscal Year | |
| Unit 2 Cooling Tower Upgrade - Installation | $4,000,000 |
| | **$4,000,000** |

* (Those shown with asterisk above are already identified within current or upcoming budgets)

# IGS Planned Uprate Projects

1. High Pressure Turbine Retrofit:
   The high pressure turbine on each unit at IGS is scheduled to be replaced with a current technology, high efficiency turbine. This unit will increase high pressure turbine efficiency from approximately 84% to over 92%. Additionally, the turbine will be sized to provide up to 4.5% additional output.

2. Cooling Tower Performance Upgrade:
   The cooling towers on each unit at IGS are scheduled for performance enhancement modifications beginning in 2003 with Unit 1. The enhancements will be designed to support full load operation at 6.9 Mlbs/hr turbine steam flow.

3. Boiler Safety Valve Additions:
   A review is currently underway focused on current boiler safety valve capacity. Addition of one main steam safety valve on each unit is expected in order to address reliability concerns with the existing valves and to accommodate the planned 4.5% increase in turbine output.

4. Generator Cooling Enhancement:
   An engineering evaluation is currently underway to identify any enhancements required on the generator in order to accommodate the planned 8.6% increase in generator output. The anticipated result of this evaluation is an upgrade to the current stator cooling systems.

5. Isophase Bus Cooling Enhancement:
   An engineering evaluation is currently underway to identify any enhancements required on the 26kv generator electrical bus feeding the main step-up transformer. The anticipated result of this evaluation is an upgrade to the current isophase bus duct cooling systems.

6. Large Motor Bus Loading Equalization:
   An engineering evaluation is currently underway to equalize the loading between the large and small motor buswork at IGS. Due to limited tap adjustment capability on the auxiliary transformers feeding these load centers, several motors must be moved from one supply to the other in order to maintain required motor terminal voltages as unit output is increased.

7. Boiler Feed Pump Performance Upgrade:
   The boiler feed pump manufacturer has notified Intermountain of several enhancements they now offer that address previous reliability concerns and allow for small increases in output. These include, improved bearing housings, flow path smoothing, and impeller clearance modifications. These modifications provide for increased pump output at acceptable reliability levels.

8. Main Step-up Transformer Cooling:
   The step-up transformers currently run close to their nominal temperature ratings on the hottest few summer days. These modifications are directed at increasing the cooling system capacity for cooling the transformer oil and frame.

9. NOx Reduction Project:
   Recent advances in the burner industry have resulted in published operational data showing NOx in the 0.20 lbs/MMbtu range. Within this project, burners in Unit 1 would be replaced first in 2003. Following successful testing, Unit 2 would follow in the successive 2004 outage.

10. Scrubber Wall Ring:
   Scrubber wall ring technology has been developed and patented in recent years to address inefficient flow patterns that routinely develop within the absorber vessels. This ring would be installed within all twelve (12) scrubber absorber vessels to move flow back to the center of the vessel, providing more efficient scrubbing of the gas.

11. Generator Stator Cooling Water Oxygen Monitoring System:
   Given concerns in recent years regarding the long term integrity of the generator stator bars, an oxygen monitoring system, capable of early identification of stator bar degradation is essential. As load increases, stator bar temperature and cooling flow velocities are also expected to rise. This system will guard against unexpected degradation of the stator.

12. High Pressure Heater Drain Line Modifications:
   An existing resonant vibration occurring in the high pressure heater drain line to the deaerator has become an increasing concern. The vibration appears to increase with load. An increase in unit output would required a modification to eliminate this concern.

13. Boiler Modifications:
   A comprehensive study is currently underway with the manufacturer of the boilers at Intermountain (Babcock & Wilcox). This study has been designed to review all aspects of boiler operation at the new turbine output levels. This study includes evaluation of current technologies and operating practices for minimizing emissions. The study will provide recommendations for modifying the existing boilers for stable and efficient operation at the new higher rating.

14. Circulating Water Makeup Modifications:
   In summer months, current circulating water makeup capacity is inadequate. If it were not for nighttime reduced evaporation rates, the existing system would be inadequate at current full load levels. The new design will support the increase makeup requirements and return a degree of redundancy to the system, as originally designed.

15. Cooling Tower Transformer Capacity:
   The transformers feeding the cooling tower fan motors have reached their design capacity. Further increases in electrical load would encroach on design redundancy margins. A study will be performed to identify and resolve the required redundancy issues for operation at the new output levels.

INTERMOUNTAIN POWER SERVICE CORPORATION

# STATION UPRATE OPERATIONAL GUIDANCE MANUAL

INTERMOUNTAIN POWER SERVICE CORPORATION

Station Uprate Operational Guidance Manual

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INTERMOUNTAIN POWER SERVICE CORPORATION

Station Uprate Operational Guidance Manual

## I. Purpose of Manual

Beginning in approximately October of 2000, Intermountain Power Service Corporation undertook an aggressive program to maximize generating output by utilizing existing margins in generating systems equipment. An intensive review effort, involving the OEM design groups of each of the major equipment manufacturers, was completed. Following this review a gross-output target of 950MW per unit was selected and approved by the IPA Board of Directors.

At the inception of this program it became apparent that advancements in turbine steam path technology would provide additional increments of power generation output. The additional generation associated with the significant improvements in turbine technology provided a favorable economic foundation for the overall project.

This manual has been prepared for use in operating and troubleshooting the various systems modified as part of the station uprate project. Refinements in operational setpoints and/or installed hardware may be required for optimizing emissions, heat rate and operating stability. Careful attention will be paid to early operation at 950MW to assist operations in identifying and implementing the required adjustments and refinements to maintain IPSC's enviable records in availability and reliability.

INTERMOUNTAIN POWER SERVICE CORPORATION

Station Uprate Operational Guidance Manual

## II. Station Uprate Project Economics

Analysis of individual plant systems provided the basis both for confidence in achieving the target gross generation output of 950MW on each unit and for preparing project estimates for the required modifications in each case. A conservative but responsible total estimate of $36 million was originally set and approved for completion of the uprate on both Units 1 & 2 at Intermountain.

With time, the detailed design of the various modifications has provided more accuracy in the project estimates. As shown in the attached economic breakdown, a high confidence estimate of total project costs now sits at $26.7 million. Approximately $10 million under the original conservative estimate.

Using a conservative (lower end) cost of replacement energy of $25/MWH and a nominal capacity factor of 90%, the uprate is expected to pay for itself within one year of operation. The cost of the additional generation produced by the uprate project is less than half the nominally specified replacement power cost for IPP.

Many of the concerns, associated with availability of power, in existence at the time the project was initiated are now lessened. However, current market trends in gas and oil prices will make these currently attractive megawatts, increasingly valuable.

Station Uprate Operational Guidance Manual

# III. Uprate Project Operational Information

## A. High Pressure Turbine Retrofit

### *Project Overview*

The high pressure section of the main turbine is being replaced with a newer technology design. The design changes have shown, on Unit 2, to result in a section efficiency improvement of approximately 8.5%. The effect on output is an approximate 20 megawatt increase for the same steam flow.

The efficiency improvement in the HP section is produced by a combination of two design aspects. First; the addition of one extra stage of turbine blading. The addition of this stage allows a more effective distribution of the available energy in the steam at each stage. Second; 3 dimensional, larger, steam path blading that provides more effective turning of the steam with lower surface/end losses.

### *Initial Startup Issues*

Turbine manufacturers are unable to produce turbine steam path components to greater than 2% accuracy in throat area. Therefore it may be necessary to adjust the throttle pressure setpoint during initial operation to achieve the desired 950MW output at an optimal valve position of approximately 50%.

A thermocouple is being installed at the upper, mid-span of the outer HP casing and at the lower mid-span. The top to bottom differential is primarily a concern during startup due to preferential heating of the outer HP turbine shell from both geometry and piping configurations. Excessive top/bottom preferential heating has been linked to HP section shell deformation and packing rubs.

At present, no specific guidelines have been established for our turbine regarding allowable top/bottom HP section outer shell temperature differentials. Technical Services will be trending these inputs to provide Operations with additional information regarding the recommended temperature limits that should be maintained at these locations.

### *Operational Guidelines*

The manufacturer of the new HP section, Alstom Power Inc., specifically states that the new HP section should operate essentially identical to any other impulse design, full-arc turbine of similar size and type. The major design change from the original HP turbine section is the removal of partial arc steam admission mode. It is well recognized that going to full arc admission only, may extend the time to full load from cold startup due to the loss of rotor long compensation from partial arc mode.

Studies have been completed regarding allowable turbine blade loading under the most demanding operating conditions. The recommendations shown on the attached copy of the study performed by Alstom Power Inc., shows that load reduction from the nominal 950 MWg target is required in only three cases:

| Condition | Load Limit |
|---|---|
| 1. One HP heater string out-of-service: | 923 MW |
| 2. All six HP heaters out-of-service | 870MW |
| 3. Both 8A & 8B heaters out-of-service | 942 MW |

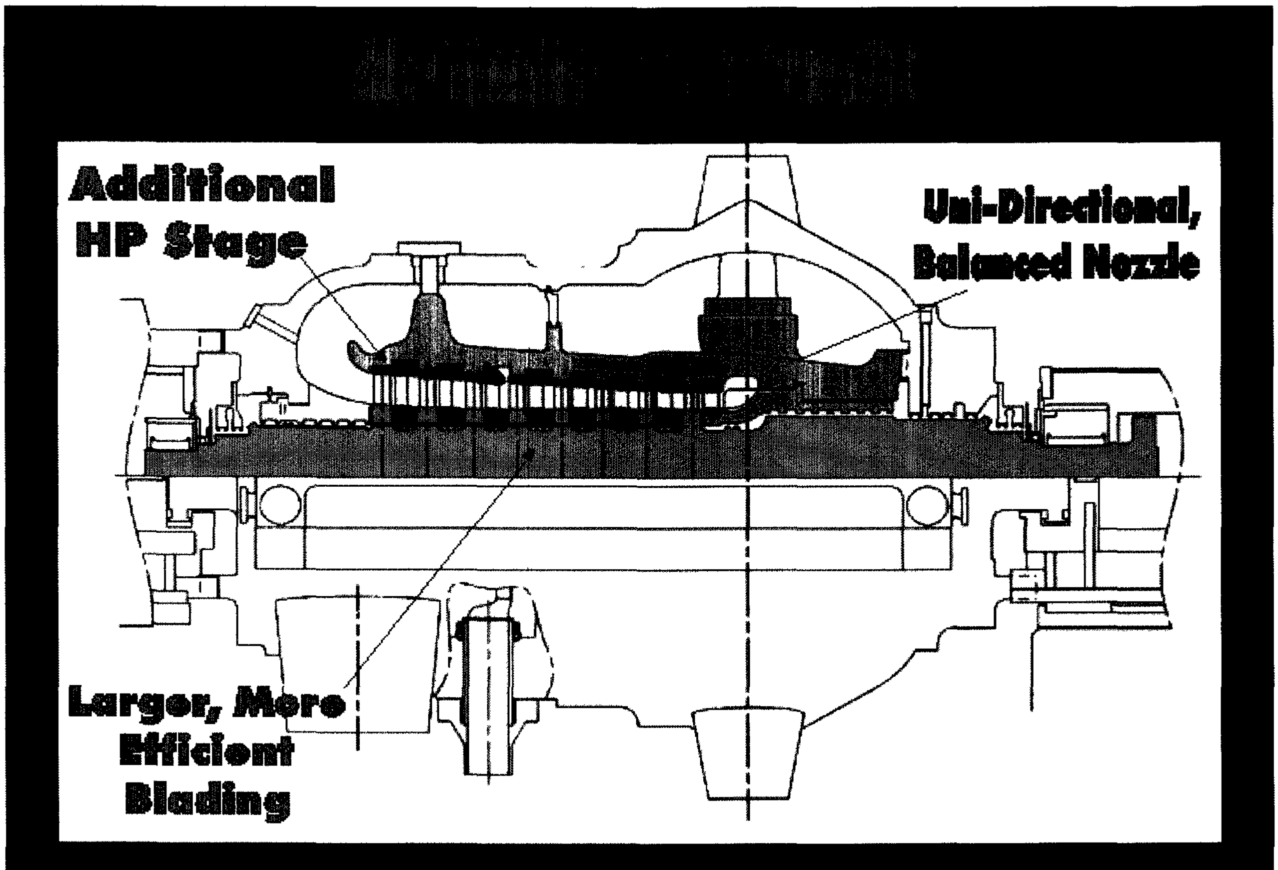
The following data table provides a more concise listing of the significant design and operational parameters and guidelines associated with the new HP turbine section.

**TABLE 1 - INTERMOUNTAIN POWER GENERATION TURBINE RETROFIT MAJOR INTERFACE LIST**

| No | Description | Alstom | GE | Effect or Comments |
|---|---|---|---|---|
| 1 | Critical Speed, rpm<br>• 1st<br>• 2nd | <br>~1750<br>~4300 | <br>~1950<br>~4550 | These are the criticals associated with the HP section only. |
| 2 | Control Valve Change to Full Arc | Full Arc | Partial or Full Arc | All four CVs open or close simultaneously. There will no longer be any choice between partial arc and full arc operation.<br><br>ALSTOM is providing (through Novatech) new digital position boards for the HP control valves. Some minor wiring changes will also be required within the governor panel and full instructions for this work will be provided. Following fitting of the new boards, it will be necessary to stroke the valves to set up the full open and full closed positions. |
| 3 | Startup | Adhere to GE's | GE | No change. All starts are to be performed in according to the existing GE instructions using HP Inlet inner surface temperature in place of 1st stage inner surface temperature. However, the reduction of the radial spill strip and turbine end axial clearances require an absolute adherence to the GE procedures. |
| 4 | Shutdown | Adhere to GE's | GE | All shutdowns are to be performed to the existing GE instructions. |
| 5 | Normal Operation | Adhere to GE's | GE | Operation, rates of loading and unloading remain as per the existing GE instructions. |
| 6 | Radial Clearances<br>• N2 Packing<br>• N1 Packing<br>• Diaphragm Packing<br>• Spill Strip Packing | <br>20 mils<br>20 mils<br>24 mils<br>28 mils | <br>15 mils<br>15 mils<br>15 mils<br>50 mils | <br>33% greater than GE's<br>33% greater than GE's<br>60% greater than GE's<br>44% less than GE's. This is the most probable rubbing area. |
| 7 | Axial Clearances<br>• Turbine end, wheel base to diaph inner ring "D" and "P"<br>• Bucket to partition, generator end, (L')<br>• Bucket shroud to diaph outer ring, generator end, (N) | <br>Vary<br>Vary<br>Vary | <br>Vary<br>Vary<br>Vary | <br>10% to 60% less than GE's. The Alstom axial clearances D and P (wheel base to diaphragm inner ring, TE) are smaller than the GE's. The "P" clearance is the smallest and most probable rubbing clearance in axial direction, for a rotor long (rotor expands faster than shell or shell contracts faster than rotor) condition.<br>7% to 34% greater than GE's<br>1% to 17% greater than GE's |

| TABLE 1 - INTERMOUNTAIN POWER GENERATION TURBINE RETROFIT MAJOR INTERFACE LIST | | | | |
|---|---|---|---|---|
| **No** | **Description** | **Alstom** | **GE** | **Effect or Comments** |
| 8 | High Pressure Heater Extraction Pressure @ VWO | 1096 psia | 1094 psia | The new pressure is close to the original value |
| 9 | 1st Stage Inner Surface Temp | HP Inlet | 1st Stage Inner Shell | Reposition the HP inlet inner surface thermocouple to the steam inlet. The new thermocouples should provide similar outputs in terms of temperature and response. Descriptions in the GE instruction manual and TGSI will be changed to "HP Inlet Inner Surface Temperature" from "1st Stage Shell Metal Temperature" |
| 10 | 1st Stage Pressure | HP Leads Upstream of Bowl | 1st Stage Inner Shell | The 1st stage pressure is used by the boiler controls as a measure of steam flow. With full arc admission the HP inlet pipe pressure is proportional to steam flow, therefore it is normal practice to use inlet pipe pressure in place of 1st stage pressure as a measure of steam flow. |
| 11 | IP Rotor Cooling Steam | 816F | 829F | OK |
| 12 | HP Differential Expansion Alarms (DX1):<br>• Rotor Long Alarm Hi-Hi<br>• Rotor Long Alarm<br>• Cold Set (reference)<br>• Rotor Short Alarm<br>• Rotor short Alarm Hi-Hi | <br><br>+0.430"<br>+0.400"<br>0.000"<br>-0.150"<br>-0.170" | <br><br>0.200"<br>0.230"<br>0.630"<br>0.780"<br>0.800" | The new HP turbine is consistent with the existing GE differential expansion alarm and limit values. |
| 13 | Rotor Vibration Alarms | No Change | GE | High speed balance up to 4300 rpm indicated maximum peak to peak vibration of less than 0.75 mils. |
| 14 | Bearing Temperature Alarms | No Change | GE | OK |
| 15 | HP Water Detection, Tops and Bottoms | No Change | GE | OK |

*Drawings*




- New Inner Casing Showing Steam Flow Path -

Station Uprate Operational Guidance Manual

B. Boiler Modifications

***Project Overview***

Modifications to the boiler include both capacity provisions for achieving the 950 MWg target and performance enhancements for improved operational stability. The modifications are as follows:

- Platen Superheater Extension
- Overfire Air Addition (OFA)
- Drum Flow Distribution and Level Indication Stability Modifications
- Main Steam and Reheat Safety Relief Valve Additions and Re-rates

The platen extensions constitute an approximate 10% increase in the overall platen superheater surface area. This increase in surface area yields an increase in platen energy absorption of nearly 13%. Steam temperature targets have not changed with these modifications. Platen superheat is being added specifically to allow more flexibility and stability in maintaining steam outlet temperature without losing boiler performance. In redistributing the energy absorption within the boiler, the increase superheat surface will restore valuable attemperator spray flow margins to provide better control of steam temperatures at the new full load flows. No changes in operating procedures are anticipated in connection with the platen surface addition.

The OFA system is being provided to allow for greater operational flexibility while meeting or exceeding emissions criteria, under varying fuel and load conditions. Performance guarantees associated with LOIs, carbon monoxide and steam temperature will be verified during a boiler performance test in late April 2003.

At the new design, VWO full load flow of 6.9 MMlb/hr the OEM (Babcock & Wilcox) had concerns regarding proper flow distribution within the drum. We also investigated ways of stabilizing drum level indication throughout the load range. As a result, a few small internal modifications will be made to drum internals.

Finally, in keeping with the new full load design flow rating of the boiler, the electromatic relief valve previously know as ERV #3 will now be replaced with a mechanical relief valve similar to the existing main steam safety relief valves #5 and #6. The new valve will be known as Main Steam Safety Relief Valve #4.

***Initial Startup Issues***

Control adjustments to the overfire air system are expected during the initial ascent to full load. During the first week of operation, while turbine balance and overspeed issues are being addressed, technical support personnel from BPI Inc., the OFA designers will be on-site to assist ES in optimizing the OFA system.

Startup screens are being placed in the turbine stop valves and the BFPT main steam stop valves to protect this equipment from solid particles that were not removed in the boiler component cleaning phase prior to installation. Tentative plans call for a short unit outage after approximately one week of operation to remove all startup screens.

***Operational Guidelines***
The OFA system is designed to operate without the need for constant operator attention. Control of combustion air flows and overfire air flows will be maintained within the existing CCS system. Computer manual control is available at all times.

The operational interface with the OFA system will consist of three Videospec screens.
1. The first screen will display both current system operational parameters (i.e., flow, temperatures, etc.) and provide master control of the OFA system.
2. The second screen will allow control of the 1/3 and 2/3 port dampers.
3. The third screen allows control of the new OFA compartment dampers (4 ea.)

In accordance with OEM specifications the OFA port dampers will be controlled as follows:

| Load | Port Dampers | Compartment Dampers |
|---|---|---|
| 0-60% | 5% (port cooling) | 5% (port cooling) |
| 60% - 75% | 1/3 dmpr. open, 2/3 dmpr. closed | Open |
| 75% - 90% | 2/3 dmpr. open, 1/3 dmpr. closed | Open |
| 90% - 100% | All open | Open |

(Modifications to this guideline will likely be forthcoming as CO emissions and unburned carbon levels are verified in operational testing.)

The OFA system consists of the addition of 16 ports in the furnace directly above the top row of burners, ($9^{th}$ level). Eight ports installed in the front wall and eight in the rear wall. These ports will each be designed with parallel 1/3 and 2/3 dampers. Each of the two rows of ports will be outfitted with windbox compartment dampers at each end of the respective windbox compartment.

The OFA system extracts a portion of the combustion air normally fed into the existing burner windbox compartments. The percent of total combustion air fed into the OFA compartment is determined by FD fan output and the degree to which the combustion air flow is restricted at the existing burner levels.

Incrementally increasing the air flow into the OFA system, under nominal conditions, should be expected to decrease CO emission levels. Incrementally decreasing air to the burner levels should be expected to decrease NOx emissions levels but increase LOI levels. Proper operation of the OFA system will consist of a balance in these factors. Overall, the goal will be to keep the NOx emission levels at or below 0.37 lbs/MMBTU on a 30 day rolling average basis without unacceptably affecting unburned carbon percentages. Adjustments to OFA operating parameters will likely be required with the anticipated changes in fuel chemistry/sources.

Within the first two weeks of operation, the OFA system will be monitored and tuned for stable operation throughout the turbine testing period. At approximately 5-6 weeks after startup, a full boiler optimization test will occur. During this testing, performance parameters associated with contract guarantees will be verified and further control adjustments will be made in accordance with operating experience.

The location of the new OFA system feeder ducts will now obstruct access to the sides of the furnace from the 9th level. Access to furnace equipment located between the new OFA feeder ducts, such as the boiler cameras, will now be accomplished from stairways installed at the eighth level crosswalks on each side of the furnace. Provisions are underway to assist operators with periodic boiler camera cleaning, as cleaning access through boiler corner ports will now be unavailable.

All dampers, four (4) each compartment dampers and eight (8) each port (1/3, 2/3) dampers will be actuated and remotely operable from the main control panel. OFA compartment air flow will be sensed at each end of both OFA compartments (front and rear). Indication of compartment air flow and damper position control blocks will be displayed on the main control panel on a videospec screen built specifically for OFA system control. Additionally, differential pressure (flow) instruments will be provided at the throat of each OFA port at local displays. These port flow indicators will be used primarily for side to side, on-line balancing of OFA port flows.

The modifications made to the drum are expected to improve drum level reliability and consistency. Several of the downspouts have been redirected to distribute condensate flow more evenly throughout the drum. Also the drum level sensing taps have been moved approximately 15 feet closer to the outer ends of the drum. These changes should ensure more stability in drum levels indications during transient operation, especially at higher loads.

With the installation of one additional main steam safety valve the new nameplate flow rating on the boiler will be 6.9MMlbs/hr. With this additional valve we are maintaining the redundancy previously existing in the main steam safeties at the new full load steam flow rating of approximately 6.65MMlbs/hr. At this new full load flow rating any one of safety relief valves #4, #5 or #6 can be removed from service without affecting full load capacity. The safety relief valves settings will hereafter be as follows:

| Valve # | Old Set Pressure (psia) | New Set Pressure(psia) |
|---|---|---|
| 1SGG-RV4(new) | NA | 2855 |
| 1SGG-RV5 | 2815 | 2835 |
| 1SGG-RV6 | 2800 | 2815 |
| 1SGG-RV7 | 2785 | 2795 |
| 1SGG-RV8 | 2775 | 2775 |
| 1SGJ-RV1 | 681 | 750 |
| 1SGJ-RV2 | 681 | 750 |
| 1SGJ-RV3 | 692 | 755 |
| 1SGJ-RV4 | 692 | 755 |
| 1SGJ-RV5 | 700 | 760 |
| 1SGJ-RV6 | 700 | 760 |
| 1SGJ-RV7 | 705 | 770 |
| 1SGJ-RV8 | 705 | 770 |
| 1SGJ-RV9 | 630 | 698 |

| Valve # | Old Set Pressure (psia) | New Set Pressure(psia) |
|---|---|---|
| 1SGJ-RV10 | 630 | 698 |
| 1SGJ-RV11 | 640 | 720 |
| 1SGJ-RV12 | 640 | 720 |

The actual full load steam flow will be a function of the new HP section efficiency and will be established during the Unit 1 performance testing within the month of April. Unit 2 full load flow was tested at approximately 6.65 MMlbs/hr.

Station Uprate Operational Guidance Manual

C. Helper Cooling Tower

***Project Overview***

A helper cooling tower is being installed directly east of the existing cooling towers to augment heat removal requirements at 950MW. The helper tower design allows for a 13% increase in overall cycle heat rejection. This increase will permit the units to run at nominal condenser backpressure throughout the summer months.

The helper tower will operate in a parallel flow path with the existing cooling towers. The new tower will be designed to cool approximately 15% of the total circulating water flow. In support of this flow to the helper tower the circulating water pumps are also being upgraded by approximately 10%.

***Initial Startup Issues***

No startup concerns are anticipated.

***Operational Guidelines***

Operating procedures will be issued prior to releasing the towers to operation in mid-June 2003.

***Drawings***

The attached schematics have been modified to show the new helper tower ties to the existing heat rejection system.

INTERMOUNTAIN POWER SERVICE CORPORATION

Station Uprate Operational Guidance Manual

D. Isophase Bus Cooling

***Project Overview***

The isolated phase bus duct was originally designed to operate at a maximum of 23,100 amperes at 26 kV or approximately 1040 MVA. This rating provided significant thermal and electrical margin because the generator was originally operated at 880 MVA (840 MW @ >.95 power factor). Even with the generator output increased to 990 MVA (950 MW @ >.96 power factor) the isolated phase bus is still within original design current limits.

However our operating experience with the isolated phase bus at both 840 and 875 MW indicated the bus is operating at higher than design temperatures. The bus was supposed to have been designed so the maximum operating temperature of the enclosure did not exceed 80° C and the temperature of the conductor did not exceed 100° C. We have measured temperatures in excess of 110° C on the generator terminal enclosure and we have had problems with the oxide inhibiting grease on the conductor terminal hardening because of high temperature. Using irreversible temperature strips we have measured temperatures in excess of 160° C on the generator terminals.

In order to resolve concerns about the bus operating temperatures and provide additional thermal and electrical margin we had the bus manufacturer, Delta-Unibus perform an up rate study. Based on the results of the uprate study they are recommended we install a forced cooling system at the generator terminal.

***Initial Startup Issues***

None expected.

***Operational Guidelines***

The cooling system is designed to draw air from the building, filter the air and then blow the air from the generator terminal to the generator breaker and from the generator breaker to the transformer. The fan unit will be powered by a 15 HP 3ph 460v motor and will provide 10,000 cfm of total cooling air. The fan unit will be belt driven by one motor and a spare motor will be installed but not connected. If the operating motor fails it will be necessary to install belts on the spare motor.

The cooling system is designed to start automatically when the generator circuit breaker is closed and is also provided with a manual start switch. The control circuit is designed to be fail safe. If any component in the control circuit fails the fan unit will start. If the fan fails to provide adequate airflow an alarm will be sent to the control room Rochester CRT display entitled, "ISOPHASE BUS FAN FAILURE" so the status of the fan unit can be checked.

Should the air handler become inoperable, the temperature indicators mounted on the south side of A phase and the north side of C phase should be monitored to see that these temperatures stabilize below 105°C. Where this does not appear probable, remedial action should be discussed with Engineering Services.

E. Scrubber Forced Oxidation System

***Project Overview***

A forced oxidation system is currently being installed in the Unit 1 Scrubber Reaction Tanks starting with tanks A, B, E and F. Retrofit of the Unit 2 Reaction Tanks and the remainder of the Unit 1 tanks will be addressed in the near future as equipment availability and material procurement allows.

The scrubber forced oxidation system is designed to provide the additional air needed to increase oxidation of the sulfite ions to sulfate within all operating flue gas desulfurization (FGD) absorber module reaction tanks. The additional air increases the production of the calcium sulfate dehydrate ($CaSO_4 \bullet 2H_20$) byproduct solids.

The forced oxidation system is required primarily because of the increasing sulfur content in current fuel sources. When scrubber sulfur loading increases, the existing equipment is unable to adequately oxygenate the scrubber liquor. This lack of oxygenation allows the sulfur to precipitate in very small crystals called sulfite ($CaSO_3$). The sulfite crystals cause serious problems in dewatering the scrubber effluent but are an even greater concern in causing absorber module scaling. Plugging problems resulting from this scaling in recent months have been a serious concern in both unit scrubbers.

The uprate, although a factor in increased sulfur throughput, is a relatively small factor compared to the increased sulfur percentages within specific fuel sources.

***Initial Startup Issues***

The forced oxidation systems associated with Unit 1 Scrubber Modules A, B, E and F will be available for manual operation at the end of the current Unit 1 outage. Availability of the Unit 2 system and the remaining Unit 1 modules will depend upon the required schedule for accommodating the higher sulfur fuels.

Currently, U2 Module 1C is scheduled for forced oxidation retrofit to be completed in mid April. A schedule for the remaining modules will be provided soon as approved by Staff.

Due to parts and equipment availability, the forced oxidation system will initially be tied to the discharge of the existing Flyash Air Compressor 1C on each unit. The forced oxidation air piping will temporarily be connected through the abandoned combustion gas reheat return lines to the 1C Flyash Air Compressor. Following receipt and installation of the dedicated, forced oxidation blowers to be located in the north bays of each scrubber building, the 1C Flyash Air Compressor will be returned to normal service.

As a result of forced oxidation system operation, foam generation within the scrubber reaction tanks is anticipated, especially in summer and fall months. Initially, control of this foaming will be the responsibility of Operations. A project priority in the near term is to complete installation of an automated defoamer injection system that, although requiring operator attention, will greatly reduce the burden and increase the controllability of this ongoing problem.

Startup and initial operation of the forced oxidation system will be primarily in manual modes until installation of the remaining field instrumentation and actuators are complete. The system is currently scheduled to be fully operational by the end of April.

Systems required in-service for initial startup of the forced oxidation system include:
- Flyash Air Compressor 1C
- Closed cycle cooling water system for Flyash Air Compressor 1C interstage cooling
- Service water header tie to the specific module humidification system piping
- Correct valve lineup on the new oxidation piping including manual discharge valve (1ASB-BV-735)

The logic for the 1C Flyash Air Compressor has been separated from the flyash system. The 1C Compressor can be directly restored for operation of the flyash system should an emergency condition arise.

A control switch has been temporarily installed inside the flyash control panel to start the 1C Compressor. The switch for the permanent blower will be panel mounted externally at the time of blower installation (ETA 8/15/03). The switch allows for operation of the 1C Compressor either as a forced oxidation blower (left) or as a flyash air compressor (right). All other features of compressor operation including closed cycle cooling valve and unloading valve permits for compressor start, remain unchanged.

Prior to starting 1C Compressor, at least two (2) modules must be valved into the forced oxidation header. See attached P&ID identifying the schematic location of the appropriate valves. After establishing air flow, the 8", module oxidation throttling valves must be adjusted to balance the available flow to all in-service modules. Every effort should be made to maintain humidified air temperatures below 180°F.

***Operational Guidelines***
Every effort should be made to maintain humidified air temperatures below 180°F, as shown on the temperature indicators located directly downstream of the humidification stations at each air header (6 per reaction tank). The humidification stations must remain in service whenever oxidation air is flowing to the associated reaction tank. Continuous operation of the humidification station is encouraged unless the respective module and air system are being removed from service for extended periods.

INTERMOUNTAIN POWER SERVICE CORPORATION

# STATION UPRATE OPERATIONAL GUIDANCE MANUAL

INTERMOUNTAIN POWER SERVICE CORPORATION

# Station Uprate Operational Guidance Manual

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INTERMOUNTAIN POWER SERVICE CORPORATION

# Station Uprate Operational Guidance Manual

## I. Purpose of Manual

Beginning in approximately October of 2000, Intermountain Power Service Corporation undertook an aggressive program to maximize generating output by utilizing existing margins in generating systems equipment. An intensive review effort, involving the OEM design groups of each of the major equipment manufacturers was completed. Following this review a gross output target of 950MW per unit was selected and approved by the IPA Board of Directors.

At the inception of this program it became apparent that advancements in turbine steam path technology would provide additional increments of power generation output. The additional generation associated with the significant improvements in turbine technology provided a favorable economic foundation for the overall project.

This manual has been prepared for use in operating and troubleshooting the various systems modified as part of the station uprate project. Refinements in operational setpoints and/or installed hardware may be required for optimizing emissions, heat rate and operating stability. Careful attention will be paid to early operation at 950MW to assist operations in identifying and implementing the required adjustments and refinements to maintain IPSC's enviable records in availability and reliability.

INTERMOUNTAIN POWER SERVICE CORPORATION

Station Uprate Operational Guidance Manual

## II. Station Uprate Project Economics

Analysis of individual plant systems provided the basis both for confidence in achieving the target gross generation output of 950MW on each unit and for preparing project estimates for the required modifications in each case. A conservative but responsible total estimate of $36 million was originally set and approved for completion of the uprate on both Units 1 & 2 at Intermountain.

With time, the detailed design of the various modifications has provided more accuracy in the project estimates. As shown in the attached economic breakdown, a high confidence estimate of total project costs now sits at $26.7 million. Approximately $10 million under the original conservative estimate.

Using a conservative (lower end) cost of replacement energy of $25/MWH and a nominal capacity factor of 90%, the uprate is expected to pay for itself within one year of operation. The cost of the additional generation produced by the uprate project is less than half the nominally specified replacement power cost for IPP.

Many of the concerns, associated with availability of power, in existence at the time the project was initiated are now lessened. However, current market trends in gas and oil prices will make these currently attractive megawatts, increasingly valuable.

Station Uprate Operational Guidance Manual

# III. Uprate Project Operational Information

## A. High Pressure Turbine Retrofit

***Project Overview***

The high pressure section of the main turbine is being replaced with a newer technology design. The design changes have shown, on Unit 2, to result in a section efficiency improvement of approximately 8.5%. The effect on output is an approximate 20 megawatt increase for the same steam flow.

The efficiency improvement in the HP section is produced by a combination of two design aspects. First; the addition of one extra stage of turbine blading. The addition of this stage allows a more effective distribution of the available energy in the steam at each stage. Second; 3 dimensional, larger, steam path blading that provides more effective turning of the steam with lower surface/end losses.

***Initial Startup Issues***

Turbine manufacturers are unable to produce turbine steam path components to greater than 2% accuracy in throat area. Therefore it may be necessary to adjust the throttle pressure setpoint during initial operation to achieve the desired 950MW output at an optimal valve position of about 40%.

A thermocouple is being installed at the upper, mid-span of the outer HP casing and at the lower mid-span. The top to bottom differential is primarily a concern during startup due to preferential heating of the outer HP turbine shell from both geometry and piping configurations. Excessive top/bottom preferential heating has been linked to HP section shell deformation and packing rubs.

At present, no specific guidelines have been established for our turbine regarding allowable top/bottom HP section outer shell temperature differentials. Tech. Services will be trending these inputs to provide Operations with additional information regarding the recommended temperature limits that should be maintained at these locations.

***Operational Guidelines***
The manufacturer of the new HP section, Alstom Power Inc., specifically states that the new HP section should operate essentially identical to any other impulse design, full-arc turbine of similar size and type. The major design change from the original HP turbine section is the removal of partial arc steam admission mode. It is well recognized that going to full arc admission only, may notably extend the time to full load from cold startup due to the loss of rotor long compensation from partial arc mode.

Studies have been completed regarding allowable turbine blade loading under the most demanding operating conditions. The recommendations shown on the attached copy of the study performed by Alstom Power Inc., shows that load reduction from the nominal 950 MWg target is required in only three cases:

| Condition | Load Limit |
|---|---|
| 1. One HP heater string out-of-service: | 923 MW |
| 2. All six HP heaters out-of-service | 870MW |
| 3. Both 8A & 8B heaters out-of-service | 942 MW |

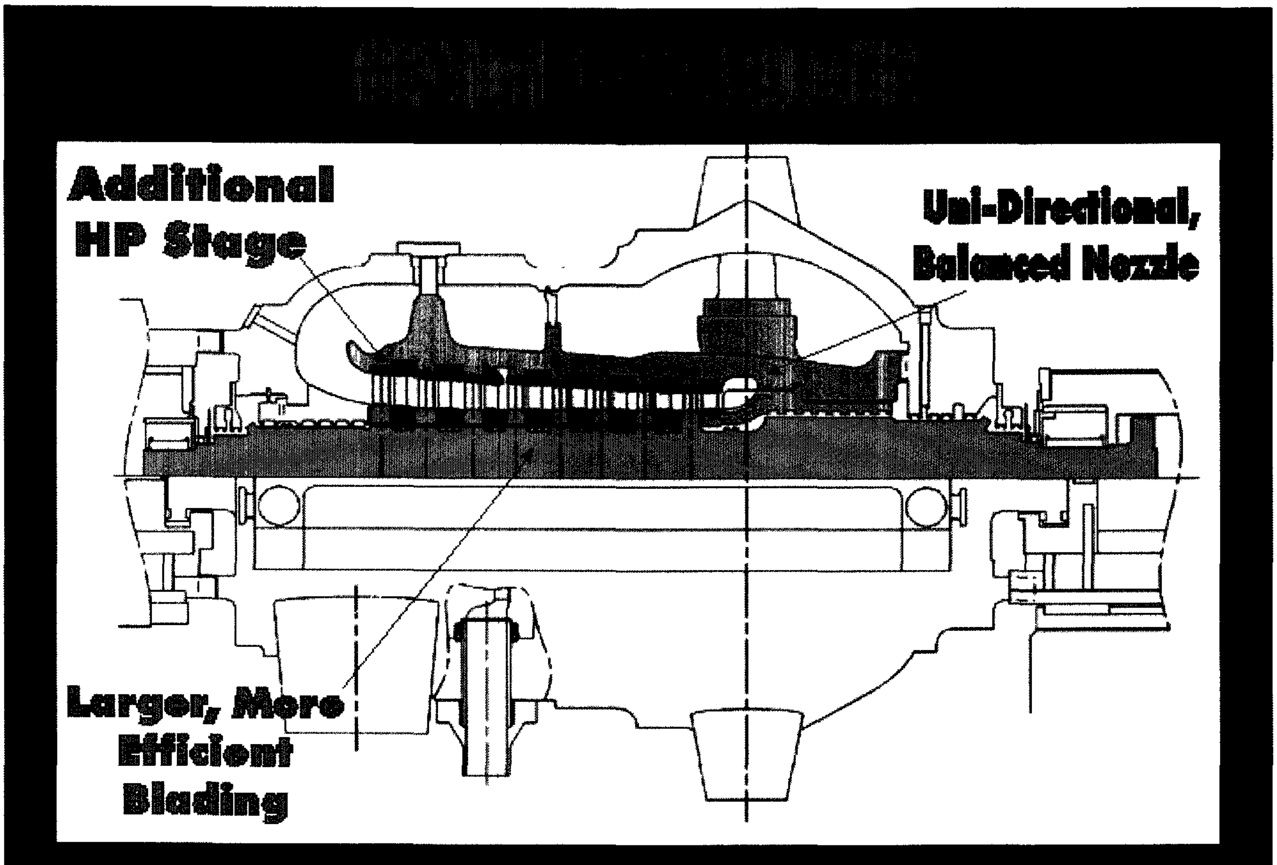
The following data table provides a more concise listing of the significant design and operational parameters and guidelines associated with the new HP turbine section.

**TABLE 1 - INTERMOUNTAIN POWER GENERATION TURBINE RETROFIT MAJOR INTERFACE LIST**

| No. | Description | Alstom | GE | Effect or Comments |
|---|---|---|---|---|
| 1 | Critical Speed, rpm<br>• 1st<br>• 2nd | <br>~1750<br>~4300 | <br>~1950<br>~4550 | <br>These are the criticals associated with the HP section only. |
| 2 | Control Valve Change to Full Arc | Full Arc | Partial or Full Arc | All four CVs open or close simultaneously. There will no longer be any choice between partial arc and full arc operation.<br><br>ALSTOM is providing (through Novatech) new digital position boards for the HP control valves. Some minor wiring changes will also be required within the governor panel and full instructions for this work will be provided. Following fitting of the new boards, it will be necessary to stroke the valves to set up the full open and full closed positions. |
| 3 | Startup | Adhere to GE's | GE | No change. All starts are to be performed in according to the existing GE instructions using HP Inlet inner surface temperature in place of 1st stage inner surface temperature. However, the reduction of the radial spill strip and turbine end axial clearances require an absolute adherence to the GE procedures. |
| 4 | Shutdown | Adhere to GE's | GE | All shutdowns are to be performed to the existing GE instructions. |
| 5 | Normal Operation | Adhere to GE's | GE | Operation, rates of loading and unloading remain as per the existing GE instructions. |
| 6 | Radial Clearances<br>• N2 Packing<br>• N1 Packing<br>• Diaphragm Packing<br>• Spill Strip Packing | <br>20 mils<br>20 mils<br>24 mils<br>28 mils | <br>15 mils<br>15 mils<br>15 mils<br>50 mils | <br>33% greater than GE's<br>33% greater than GE's<br>60% greater than GE's<br>44% less than GE's. This is the most probable rubbing area. |

| TABLE 1 - INTERMOUNTAIN POWER GENERATION TURBINE RETROFIT MAJOR INTERFACE LIST | | | | |
|---|---|---|---|---|
| **No.** | **Description** | **Alstom** | **GE** | **Effect or Comments** |
| 7 | Axial Clearances<br>• Turbine end, wheel base to diaph inner ring "D" and "P"<br>• Bucket to partition, generator end, (L')<br>• Bucket shroud to diaph outer ring, generator end, (N) | Vary<br>Vary<br>Vary | Vary<br>Vary<br>Vary | 10% to 60% less than GE's. The Alstom axial clearances D and P (wheel base to diaphragm inner ring, TE) are smaller than the GE's. The "P" clearance is the smallest and most probable rubbing clearance in axial direction, for a rotor long (rotor expands faster than shell or shell contracts faster than rotor) condition.<br>7% to 34% greater than GE's<br>1% to 17% greater than GE's |
| 8 | High Pressure Heater Extraction Pressure @ VWO | 1096 psia | 1094 psia | The new pressure is close to the original value |
| 9 | 1st Stage Inner Surface Temp | HP Inlet | 1st Stage Inner Shell | Reposition the HP inlet inner surface thermocouple to the steam inlet. The new thermocouples should provide similar outputs in terms of temperature and response. Descriptions in the GE instruction manual and TGSI will be changed to "HP Inlet Inner Surface Temperature" from "1st Stage Shell Metal Temperature" |
| 10 | 1st Stage Pressure | HP Leads Upstream of Bowl | 1st Stage Inner Shell | The 1st stage pressure is used by the boiler controls as a measure of steam flow. With full arc admission the HP inlet pipe pressure is proportional to steam flow, therefore it is normal practice to use inlet pipe pressure in place of 1st stage pressure as a measure of steam flow. |
| 11 | IP Rotor Cooling Steam | 816F | 829F | OK |
| 12 | HP Differential Expansion Alarms (DX1):<br>• Rotor Long Alarm Hi-Hi<br>• Rotor Long Alarm<br>• Cold Set (reference)<br>• Rotor Short Alarm<br>• Rotor short Alarm Hi-Hi | <br>+0.430"<br>+0.400"<br>0.000"<br>-0.150"<br>-0.170" | <br>0.200"<br>0.230"<br>0.630"<br>0.780"<br>0.800" | The new HP turbine is consistent with the existing GE differential expansion alarm and limit values. |
| 13 | Rotor Vibration Alarms | No Change | GE | High speed balance up to 4300 rpm indicated maximum peak to peak vibration of less than 0.75 mils. |
| 14 | Bearing Temperature Alarms | No Change | GE | OK |
| 15 | HP Water Detection, Tops and Bottoms | No Change | GE | OK |

*Drawings*




- New Inner Casing Showing Steam Flow Path -

B. Boiler Modifications

***Project Overview***

Modifications to the boiler include both capacity provisions for achieving the 950 MWg target and performance enhancements for improved operational stability. The modifications are as follows:

- Platen Superheater Extension
- Overfire Air Addition (OFA)
- Drum Flow Distribution and Level Indication Stability Modifications
- Main Steam and Reheat Safety Relief Valve Additions and Re-rates

The platen extensions constitute an approximate 10% increase in the overall platen superheater surface area. This increase in surface area yields an increase in platen energy absorption of nearly 13%. Steam temperature targets have not changed with these modifications. Platen superheat is being added specifically to allow more flexibility and stability in maintaining steam outlet temperature without losing boiler performance. In redistributing the energy absorption within the boiler, the increase superheat surface will restore valuable attemperator spray flow margins to provide better control of steam temperatures at the new full load flows. No changes in operating procedures are anticipated in connection with the platen surface addition.

The OFA system is being provided to allow for greater operational flexibility while meeting or exceeding emissions criteria, under varying fuel and load conditions. Performance guarantees associated with LOIs, carbon monoxide and steam temperature will be verified during a boiler performance test in late April, 2003.

At the new design, VWO full load flow of 6.9 MMlb/hr the OEM (Babcock & Wilcox) had concerns regarding proper flow distribution within the drum. We also investigated ways of stabilizing drum level indication throughout the load range. As a result, a few small internal modifications will be made to drum internals.

Finally, in keeping with the new full load design flow rating of the boiler, the electromatic relief valve previously know as ERV #3 will now be replaced with a mechanical relief valve similar to the existing main steam safety relief valves #5 and #6. The new valve will be known as Main Steam Safety Relief Valve #4.

*Initial Startup Issues*
Control adjustments to the overfire air system are expected during the initial ascent to full load. During the first week of operation, while turbine balance and overspeed issues are being addressed, technical support personnel from BPI Inc., the OFA designers will be on-site to assist ES in optimizing the OFA system.

Startup screens are being placed in the turbine stop valves and the BFPT main steam stop valves to protect this equipment from solid particles that were not removed in the boiler component cleaning phase prior to installation. Tentative plans call for a short unit outage after approximately one week of operation to remove all startup screens.

*Operational Guidelines*
The OFA system is designed to operate without the need for constant operator attention. Control of combustion air flows and overfire air flows will be maintained within the existing CCS system. Computer manual control is available at all times.

The operational interface with the OFA system will consist of three Videospec screens.
1. The first screen will display both current system operational parameters (i.e. flow, temperatures, etc.) and provide master control of the OFA system.
2. The second screen will allow control of the 1/3 and 2/3 port dampers.
3. The third screen allows control of the new OFA compartment dampers (4 ea.)

In accordance with OEM specifications the OFA port dampers will be controlled as follows:

| Load | Port Dampers | Compartment Dampers |
|---|---|---|
| 0-60% | 5% (port cooling) | 5% (port cooling) |
| 60% - 75% | 1/3 dmpr. open, 2/3 dmpr. closed | Open |
| 75% - 90% | 2/3 dmpr. open, 1/3 dmpr. closed | Open |
| 90% - 100% | All open | Open |

(Modifications to this guideline will likely be forthcoming as CO emissions and unburned carbon levels are verified in operational testing.)

The OFA system consists of the addition of 16 ports in the furnace directly above the top row of burners, ($9^{th}$ level). Eight ports installed in the front wall and eight in the rear wall. These ports will each be designed with parallel 1/3 and 2/3 dampers. Each of the two rows of ports will be outfitted with windbox compartment dampers at each end of the respective windbox compartment.

The OFA system extracts a portion of the combustion air normally fed into the existing burner windbox compartments. The percent of total combustion air fed into the OFA compartment is determined by FD fan output and the degree to which the combustion air flow is restricted at the existing burner levels.

Incrementally increasing the air flow into the OFA system, under nominal conditions, should be expected to decrease CO emission levels. Incrementally decreasing air to the burner levels should be expected to decrease NOx emissions levels but increase LOI levels. Proper operation of the OFA system will consist of a balance in these factors. Overall, the goal will be to keep the NOx emission levels at or below 0.37 lbs/MMBTU on a 30 day rolling average basis without unacceptably affecting unburned carbon percentages. Adjustments to OFA operating parameters will likely be required with the anticipated changes in fuel chemistry/sources.

Within the first two weeks of operation, the OFA system will be monitored and tuned for stable operation throughout the turbine testing period. At approximately 5-6 weeks after startup, a full boiler optimization test will occur. During this testing, performance parameters associated with contract guarantees will be verified and further control adjustments will be made in accordance with operating experience.

The location of the new OFA system feeder ducts will now obstruct access to the sides of the furnace from the 9$^{th}$ level. Access to furnace equipment located between the new OFA feeder ducts, such as the boiler cameras, will now be accomplished from stairways installed at the eighth level crosswalks on each side of the furnace. Provisions are underway to assist operators with periodic boiler camera cleaning, as cleaning access through boiler corner ports will now be unavailable.

All dampers, four (4) each compartment dampers and eight (8) each port (1/3, 2/3) dampers will be actuated and remotely operable from the main control panel. OFA compartment air flow will be sensed at each end of both OFA compartments (front and rear). Indication of compartment air flow and damper position control blocks will be displayed on the main control panel on a videospec screen built specifically for OFA system control. Additionally, differential pressure (flow) instruments will be provided at the throat of each OFA port at local displays. These port flow indicators will be used primarily for side to side, on-line balancing of OFA port flows.

The modifications made to the drum are expected to improve drum level reliability and consistency. Several of the downspouts have been redirected to distribute condensate flow more evenly throughout the drum. Also the drum level sensing taps have been moved approximately 15 feet closer to the outer ends of the drum. These changes should ensure more stability in drum levels indications during transient operation, especially at higher loads.

With the installation of one additional main steam safety valve the new nameplate flow rating on the boiler will be 6.9MMlbs/hr. With this additional valve we are maintaining the redundancy previously existing in the main steam safeties at the new full load steam flow rating of approximately 6.65MMlbs/hr. At this new full load flow rating any one of safety relief valves #4, #5 or #6 can be removed from service without affecting full load capacity. The safety relief valves settings will hereafter be as follows:

| Valve # | Old Set Pressure (psia) | New Set Pressure(psia) |
|---|---|---|
| 1SGG-RV4(new) | NA | 2855 |
| 1SGG-RV5 | 2815 | 2835 |
| 1SGG-RV6 | 2800 | 2815 |
| 1SGG-RV7 | 2785 | 2795 |
| 1SGG-RV8 | 2775 | 2775 |
| 1SGJ-RV1 | 681 | 750 |
| 1SGJ-RV2 | 681 | 750 |
| 1SGJ-RV3 | 692 | 755 |
| 1SGJ-RV4 | 692 | 755 |
| 1SGJ-RV5 | 700 | 760 |
| 1SGJ-RV6 | 700 | 760 |
| 1SGJ-RV7 | 705 | 770 |
| 1SGJ-RV8 | 705 | 770 |
| 1SGJ-RV9 | 630 | 698 |
| 1SGJ-RV10 | 630 | 698 |
| 1SGJ-RV11 | 640 | 720 |
| 1SGJ-RV12 | 640 | 720 |

The actual full load steam flow will be a function of the new HP section efficiency and will be established during the Unit 1 performance testing within the month of April. Unit 2 full load flow was tested at approximately 6.65 MMlbs/hr.

## C. Helper Cooling Tower

***Project Overview***

A helper cooling tower is being installed directly east of the existing cooling towers to augment heat removal requirements at 950MW. The helper tower design allows for a 13% increase in overall cycle heat rejection. This increase will permit the units to run at nominal condenser backpressure throughout the summer months.

The helper tower will operate in a parallel flow path with the existing cooling towers. The new tower will be designed to cool approximately 15% of the total circulating water flow. In support of this flow to the helper tower the circulating water pumps are also being upgraded by approximately 10%.

***Initial Startup Issues***

No startup concerns are anticipated.

***Operational Guidelines***

Operating procedures will be issued prior to releasing the towers to operation in mid-June 2003.

***Drawings***

The attached schematics have been modified to show the new helper tower ties to the existing heat rejection system.

## D. Isophase Bus Cooling

***Project Overview***

The isolated phase bus duct was originally designed to operate at a maximum of 23,100 amperes at 26 kV or approximately 1040 MVA. This rating provided significant thermal and electrical margin because the generator was originally operated at 880 MVA (840 MW @ >.95 power factor). Even with the generator output increased to 990 MVA (950 MW @ >.96 power factor) the isolated phase bus is still within original design current limits.

However our operating experience with the isolated phase bus at both 840 and 875 MW indicated the bus is operating at higher than design temperatures. The bus was supposed to have been designed so the maximum operating temperature of the enclosure did not exceed 80 C and the temperature of the conductor did not exceed 100 C. We have measured temperatures in excess of 110 C on the generator terminal enclosure and we have had problems with the oxide inhibiting grease on the conductor terminal hardening because of high temperature. Using irreversible temperature strips we have measured temperatures in excess of 160 C on the generator terminals.

In order to resolve concerns about the bus operating temperatures and provide additional thermal and electrical margin we had the bus manufacturer, Delta-Unibus perform an up rate study. Based on the results of the uprate study they are recommended we install a forced cooling system at the generator terminal.

***Initial Startup Issues***

None expected.

***Operational Guidelines***

The cooling system is designed to draw air from the building, filter the air and then blow the air from the generator terminal to the generator breaker and from the generator breaker to the transformer. The fan unit will be powered by a 15 HP 3ph 460v motor and will provide 10,000 cfm of total cooling air. The fan unit will be belt driven by one motor and a spare motor will be installed but not connected. If the operating motor fails it will be necessary to install belts on the spare motor.

The cooling system is designed to start automatically when the generator circuit breaker is closed and is also provided with a manual start switch. The control circuit is designed to be fail safe. If any component in the control circuit fails the fan unit will start. If the fan fails to provide adequate airflow an alarm will be sent to the control room Rochester CRT display entitled, "ISOPHASE BUS FAN FAILURE" so the status of the fan unit can be checked.

Should the air handler become inoperable, the temperature indicators mounted on the south side of A phase and the north side of C phase should be monitored to see that these temperatures stabilize below 105°C. Where this does not appear probable, remedial action should be discussed with Eng. Services.

# Scrubber Forced Oxidation System

The first of two forced oxidation blowers has been installed in Unit 1 in the northwest corner of the scrubber building. With the installation of this first blower the Unit 1 system is now ready to be operated. A redundant (second) blower will be installed in the northeast corner of the Unit 1 scrubber building within a few weeks. An identical set of blowers will be installed in Unit 2 within the next few weeks. The first of which will be ready for turnover to Operations within the next three weeks.

The scrubber forced oxidation system is designed to provide the additional air needed to increase oxidation of the sulfite ions to sulfate within all operating flue gas desulfurization (FGD) absorber module reaction tanks. The additional air increases the production of the calcium sulfate dehydrate ($CaSO_4 \bullet 2H_20$) byproduct solids.

The forced oxidation system is required primarily because of the increasing sulfur content in current fuel sources. When scrubber sulfur loading increases, the existing equipment is unable to adequately oxygenate the scrubber liquor. This lack of oxygenation allows the sulfur to precipitate in very small crystals called sulfite ($CaSO_3$). The sulfite crystals cause serious problems in dewatering the scrubber effluent but are an even greater concern in causing absorber module scaling. Plugging problems resulting from this scaling in recent months have been a serious concern in both unit scrubbers.

The uprate, although a factor in increased sulfur throughput, is a relatively small factor compared to the increased sulfur percentages within specific fuel sources.

## Operational Guidelines

Systems required for normal startup of the forced oxidation system:

- Availability of at least one of the two 100% oxidation air blowers located at the north end of the scrubber bldgs.. (Confirm isolation of either, out-of-service blower)
- Proper lineup of oxidation air piping valves
- Isolation of the temporary connection to the 1C Flyash Air Compressor
- Proper lineup of humidification water valves, with confirmed flow to the air headers.
- Operation of the defoaming system as needed.

The new oxidation air blowers and system valving will be PLC controlled. Blower inlet vanes, discharge isolation valve, blow-off valve, lube oil pump, oil cooler fan and system actuated valves, will all be automatically placed into service as required, by the programmable controls. Blower inlet vanes will be modulated to control the pressure in the outlet piping.

Each reaction tank has two motor-operated isolation valves, each serving three oxidation air spargers. When the module is in automatic, valves are placed in service based on signal from the module PLC control logic indicating that the module is in service. When the module is in manual, switches on the control panel can be used to open or close the appropriate oxidation air isolation valves. The isolation valves are full open/full close valves that do not modulate.

A manual balancing valve, installed in series with each motor-operated isolation valve, is used to adjust the flow of air to the three air spargers being served. Individual flow transmitters upstream of each isolation valve provide air flow indication to the PI system.

One on/off water isolation valve per reaction tank is provided to allow flow to a header that distributes water to all six humidification stations at each tank. A local humidification water flow indicator is located immediately downstream of the isolation valve. Each of the two branch lines includes a manual valve that can be operated to adjust the water flow rate to the three humidification stations located downstream.

Alarm status will be generated and transmitted to the scrubber control room annunciator and to PI whenever operator attention is required. System status indications that will be displayed in the scrubber control room include:
- Forced oxidation system pressure low (can be set to auto-start backup blower)
- Oxidation system flow indication at each balancing valve (2 per reaction tank.)
- Blower 1A or 1B operating status
- Reaction tank oxidation air isolation valve status

(Setpoint adjustments for blower discharge pressure controls are located at each blower's local control panel.)

Every effort should be made to maintain humidified air temperatures below 180°F, as shown on the temperature indicators located directly downstream of the humidification stations at each air header (6 per reaction tank). The humidification stations must remain in service whenever oxidation air is flowing to the associated reaction tank. Continuous operation of the humidification station is encouraged unless the respective module and air system are being removed from service for extended periods.

INTERMOUNTAIN POWER SERVICE CORPORATION

# STATION UPRATE OPERATIONAL GUIDANCE MANUAL

INTERMOUNTAIN POWER SERVICE CORPORATION

# Station Uprate Operational Guidance Manual

## Table of Contents

INTERMOUNTAIN POWER SERVICE CORPORATION

# Station Uprate Operational Guidance Manual

## I. Purpose of Manual

Beginning in approximately October of 2000, Intermountain Power Service Corporation undertook an aggressive program to maximize generating output by utilizing existing margins in generating systems equipment. An intensive review effort, involving the OEM design groups of each of the major equipment manufacturers was completed. Following this review a gross output target of 950MW per unit was selected and approved by the IPA Board of Directors.

At the inception of this program it became apparent that advancements in turbine steam path technology would provide additional increments of power generation output. The additional generation associated with the significant improvements in turbine technology provided a favorable economic foundation for the overall project.

This manual has been prepared for use in operating and troubleshooting the various systems modified as part of the station uprate project. Refinements in operational setpoints and/or installed hardware may be required for optimizing emissions, heat rate and operating stability. Careful attention will be paid to early operation at 950MW to assist operations in identifying and implementing the required adjustments and refinements to maintain IPSC's enviable records in availability and reliability.

Station Uprate Operational Guidance Manual

## II. Station Uprate Project Economics

Analysis of individual plant systems provided the basis both for confidence in achieving the target gross generation output of 950MW on each unit and for preparing project estimates for the required modifications in each case. A conservative but responsible total estimate of $36 million was originally set and approved for completion of the uprate on both Units 1 & 2 at Intermountain.

With time, the detailed design of the various modifications has provided more accuracy in the project estimates. As shown in the attached economic breakdown, a high confidence estimate of total project costs now sits at $26.7 million. Approximately $10 million under the original conservative estimate.

Using a conservative (lower end) cost of replacement energy of $25/MWH and a nominal capacity factor of 90%, the uprate is expected to pay for itself within one year of operation. The cost of the additional generation produced by the uprate project is less than half the nominally specified replacement power cost for IPP.

Many of the concerns, associated with availability of power, in existence at the time the project was initiated are now lessened. However, current market trends in gas and oil prices will make these currently attractive megawatts, increasingly valuable.

INTERMOUNTAIN POWER SERVICE CORPORATION

Station Uprate Operational Guidance Manual

# III. Uprate Project Operational Information

## A. High Pressure Turbine Retrofit

***Project Overview***

The high pressure section of the main turbine is being replaced with a newer technology design. The design changes have shown, on Unit 2, to result in a section efficiency improvement of approximately 8.5%. The effect on output is an approximate 20 megawatt increase for the same steam flow.

The efficiency improvement in the HP section is produced by a combination of two design aspects. First; the addition of one extra stage of turbine blading. The addition of this stage allows a more effective distribution of the available energy in the steam at each stage. Second; 3 dimensional, larger, steam path blading that provides more effective turning of the steam with lower surface/end losses.

***Initial Startup Issues***

Turbine manufacturers are unable to produce turbine steam path components to greater than 2% accuracy in throat area. Therefore it may be necessary to adjust the throttle pressure setpoint during initial operation to achieve the desired 950MW output at an optimal valve position of about 40%.

A thermocouple is being installed at the upper, mid-span of the outer HP casing and at the lower mid-span. The top to bottom differential is primarily a concern during startup due to preferential heating of the outer HP turbine shell from both geometry and piping configurations. Excessive top/bottom preferential heating has been linked to HP section shell deformation and packing rubs.

At present, no specific guidelines have been established for our turbine regarding allowable top/bottom HP section outer shell temperature differentials. Tech. Services will be trending these inputs to provide Operations with additional information regarding the recommended temperature limits that should be maintained at these locations.

*Operational Guidelines*
The manufacturer of the new HP section, Alstom Power Inc., specifically states that the new HP section should operate essentially identical to any other impulse design, full-arc turbine of similar size and type. The major design change from the original HP turbine section is the removal of partial arc steam admission mode. It is well recognized that going to full arc admission only, may notably extend the time to full load from cold startup due to the loss of rotor long compensation from partial arc mode.

Studies have been completed regarding allowable turbine blade loading under the most demanding operating conditions. The recommendations shown on the attached copy of the study performed by Alstom Power Inc., shows that load reduction from the nominal 950 MWg target is required in only three cases:

| Condition | Load Limit |
|---|---|
| 1. One HP heater string out-of-service: | 923 MW |
| 2. All six HP heaters out-of-service | 870MW |
| 3. Both 8A & 8B heaters out-of-service | 942 MW |

The following data table provides a more concise listing of the significant design and operational parameters and guidelines associated with the new HP turbine section.

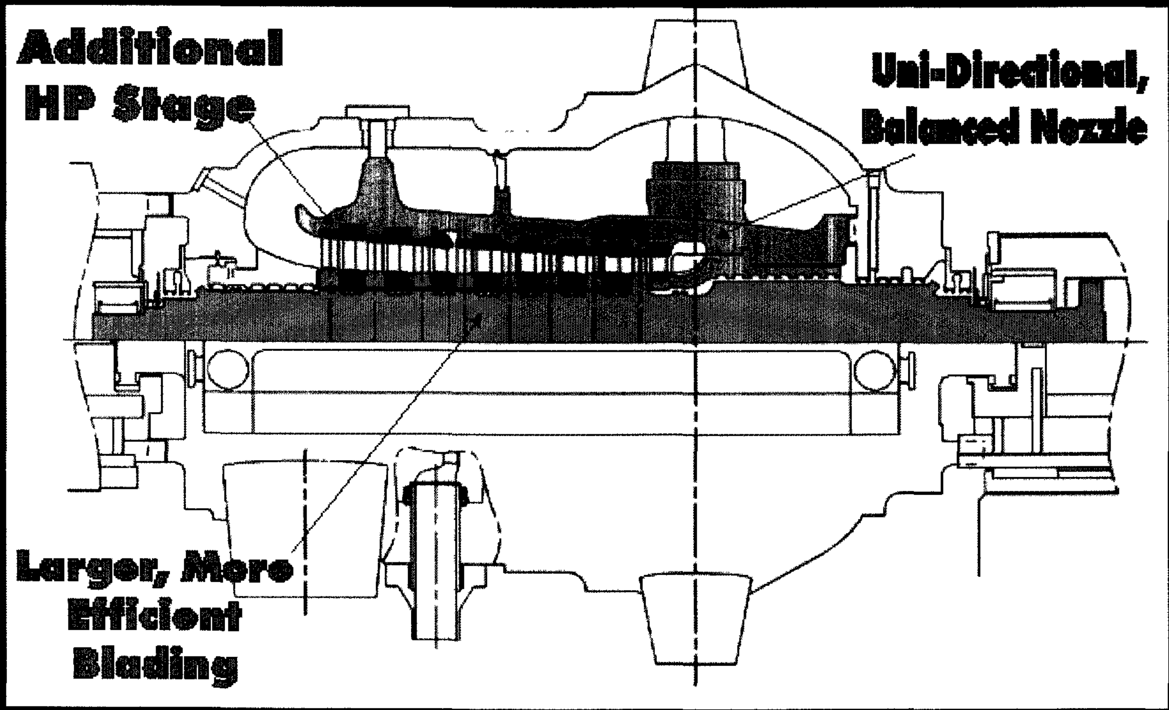
**TABLE 1 - INTERMOUNTAIN POWER GENERATION TURBINE RETROFIT MAJOR INTERFACE LIST**

| No. | Description | Alstom | GE | Effect or Comments |
|---|---|---|---|---|
| 1 | Critical Speed, rpm<br>• 1st<br>• 2nd | <br>~1750<br>~4300 | <br>~1950<br>~4550 | <br>These are the criticals associated with the HP section only. |
| 2 | Control Valve Change to Full Arc | Full Arc | Partial or Full Arc | All four CVs open or close simultaneously. There will no longer be any choice between partial arc and full arc operation.<br><br>ALSTOM is providing (through Novatech) new digital position boards for the HP control valves. Some minor wiring changes will also be required within the governor panel and full instructions for this work will be provided. Following fitting of the new boards, it will be necessary to stroke the valves to set up the full open and full closed positions. |
| 3 | Startup | Adhere to GE's | GE | No change. All starts are to be performed in according to the existing GE instructions using HP Inlet inner surface temperature in place of 1st stage inner surface temperature. However, the reduction of the radial spill strip and turbine end axial clearances require an absolute adherence to the GE procedures. |
| 4 | Shutdown | Adhere to GE's | GE | All shutdowns are to be performed to the existing GE instructions. |
| 5 | Normal Operation | Adhere to GE's | GE | Operation, rates of loading and unloading remain as per the existing GE instructions. |
| 6 | Radial Clearances<br>• N2 Packing<br>• N1 Packing<br>• Diaphragm Packing<br>• Spill Strip Packing | <br>20 mils<br>20 mils<br>24 mils<br>28 mils | <br>15 mils<br>15 mils<br>15 mils<br>50 mils | <br>33% greater than GE's<br>33% greater than GE's<br>60% greater than GE's<br>44% less than GE's. This is the most probable rubbing area. |

IP12_003428

| TABLE 1 - INTERMOUNTAIN POWER GENERATION TURBINE RETROFIT MAJOR INTERFACE LIST | | | | |
|---|---|---|---|---|
| **No.** | **Description** | **Alstom** | **GE** | **Effect or Comments** |
| 7 | Axial Clearances<br>• Turbine end, wheel base to diaph inner ring "D" and "P"<br>• Bucket to partition, generator end, (L')<br>• Bucket shroud to diaph outer ring, generator end, (N) | Vary<br>Vary<br>Vary | Vary<br>Vary<br>Vary | 10% to 60% less than GE's. The Alstom axial clearances D and P (wheel base to diaphragm inner ring, TE) are smaller than the GE's. The "P" clearance is the smallest and most probable rubbing clearance in axial direction, for a rotor long (rotor expands faster than shell or shell contracts faster than rotor) condition.<br>7% to 34% greater than GE's<br>1% to 17% greater than GE's |
| 8 | High Pressure Heater Extraction Pressure @ VWO | 1096 psia | 1094 psia | The new pressure is close to the original value |
| 9 | 1st Stage Inner Surface Temp | HP Inlet | 1st Stage Inner Shell | Reposition the HP inlet inner surface thermocouple to the steam inlet. The new thermocouples should provide similar outputs in terms of temperature and response. Descriptions in the GE instruction manual and TGSI will be changed to "HP Inlet Inner Surface Temperature" from "1st Stage Shell Metal Temperature" |
| 10 | 1st Stage Pressure | HP Leads Upstream of Bowl | 1st Stage Inner Shell | The 1st stage pressure is used by the boiler controls as a measure of steam flow. With full arc admission the HP inlet pipe pressure is proportional to steam flow, therefore it is normal practice to use inlet pipe pressure in place of 1st stage pressure as a measure of steam flow. |
| 11 | IP Rotor Cooling Steam | 816F | 829F | OK |
| 12 | HP Differential Expansion Alarms (DX1):<br>• Rotor Long Alarm Hi-Hi<br>• Rotor Long Alarm<br>• Cold Set (reference)<br>• Rotor Short Alarm<br>• Rotor short Alarm Hi-Hi | +0.430"<br>+0.400"<br>0.000"<br>-0.150"<br>-0.170" | 0.200"<br>0.230"<br>0.630"<br>0.780"<br>0.800" | The new HP turbine is consistent with the existing GE differential expansion alarm and limit values. |
| 13 | Rotor Vibration Alarms | No Change | GE | High speed balance up to 4300 rpm indicated maximum peak to peak vibration of less than 0.75 mils. |
| 14 | Bearing Temperature Alarms | No Change | GE | OK |
| 15 | HP Water Detection, Tops and Bottoms | No Change | GE | OK |

*Drawings*




- New Inner Casing Showing Steam Flow Path -

B. Boiler Modifications

***Project Overview***

Modifications to the boiler include both capacity provisions for achieving the 950 MWg target and performance enhancements for improved operational stability. The modifications are as follows:

- Platen Superheater Extension
- Overfire Air Addition (OFA)
- Drum Flow Distribution and Level Indication Stability Modifications
- Main Steam and Reheat Safety Relief Valve Additions and Re-rates

The platen extensions constitute an approximate 10% increase in the overall platen superheater surface area. This increase in surface area yields an increase in platen energy absorption of nearly 13%. Steam temperature targets have not changed with these modifications. Platen superheat is being added specifically to allow more flexibility and stability in maintaining steam outlet temperature without losing boiler performance. In redistributing the energy absorption within the boiler, the increase superheat surface will restore valuable attemperator spray flow margins to provide better control of steam temperatures at the new full load flows. No changes in operating procedures are anticipated in connection with the platen surface addition.

The OFA system is being provided to allow for greater operational flexibility while meeting or exceeding emissions criteria, under varying fuel and load conditions. Performance guarantees associated with LOIs, carbon monoxide and steam temperature will be verified during a boiler performance test in late April, 2003.

At the new design, VWO full load flow of 6.9 MMlb/hr the OEM (Babcock & Wilcox) had concerns regarding proper flow distribution within the drum. We also investigated ways of stabilizing drum level indication throughout the load range. As a result, a few small internal modifications will be made to drum internals.

Finally, in keeping with the new full load design flow rating of the boiler, the electromatic relief valve previously know as ERV #3 will now be replaced with a mechanical relief valve similar to the existing main steam safety relief valves #5 and #6. The new valve will be known as Main Steam Safety Relief Valve #4.

*Initial Startup Issues*
Control adjustments to the overfire air system are expected during the initial ascent to full load. During the first week of operation, while turbine balance and overspeed issues are being addressed, technical support personnel from BPI Inc., the OFA designers will be on-site to assist ES in optimizing the OFA system.

Startup screens are being placed in the turbine stop valves and the BFPT main steam stop valves to protect this equipment from solid particles that were not removed in the boiler component cleaning phase prior to installation. Tentative plans call for a short unit outage after approximately one week of operation to remove all startup screens.

*Operational Guidelines*
The OFA system is designed to operate without the need for constant operator attention. Control of combustion air flows and overfire air flows will be maintained within the existing CCS system. Computer manual control is available at all times.

The operational interface with the OFA system will consist of three Videospec screens.
1. The first screen will display both current system operational parameters (i.e. flow, temperatures, etc.) and provide master control of the OFA system.
2. The second screen will allow control of the 1/3 and 2/3 port dampers.
3. The third screen allows control of the new OFA compartment dampers (4 ea.)

In accordance with OEM specifications the OFA port dampers will be controlled as follows:

| Load | Port Dampers | Compartment Dampers |
|---|---|---|
| 0-60% | 5% (port cooling) | 5% (port cooling) |
| 60% - 75% | 1/3 dmpr. open, 2/3 dmpr. closed | Open |
| 75% - 90% | 2/3 dmpr. open, 1/3 dmpr. closed | Open |
| 90% - 100% | All open | Open |

(Modifications to this guideline will likely be forthcoming as CO emissions and unburned carbon levels are verified in operational testing.)

The OFA system consists of the addition of 16 ports in the furnace directly above the top row of burners, (9$^{th}$ level). Eight ports installed in the front wall and eight in the rear wall. These ports will each be designed with parallel 1/3 and 2/3 dampers. Each of the two rows of ports will be outfitted with windbox compartment dampers at each end of the respective windbox compartment.

The OFA system extracts a portion of the combustion air normally fed into the existing burner windbox compartments. The percent of total combustion air fed into the OFA compartment is determined by FD fan output and the degree to which the combustion air flow is restricted at the existing burner levels.

Incrementally increasing the air flow into the OFA system, under nominal conditions, should be expected to decrease CO emission levels. Incrementally decreasing air to the burner levels should be expected to decrease NOx emissions levels but increase LOI levels. Proper operation of the OFA system will consist of a balance in these factors. Overall, the goal will be to keep the NOx emission levels at or below 0.37 lbs/MMBTU on a 30 day rolling average basis without unacceptably affecting unburned carbon percentages. Adjustments to OFA operating parameters will likely be required with the anticipated changes in fuel chemistry/sources.

Within the first two weeks of operation, the OFA system will be monitored and tuned for stable operation throughout the turbine testing period. At approximately 5-6 weeks after startup, a full boiler optimization test will occur. During this testing, performance parameters associated with contract guarantees will be verified and further control adjustments will be made in accordance with operating experience.

The location of the new OFA system feeder ducts will now obstruct access to the sides of the furnace from the 9th level. Access to furnace equipment located between the new OFA feeder ducts, such as the boiler cameras, will now be accomplished from stairways installed at the eighth level crosswalks on each side of the furnace. Provisions are underway to assist operators with periodic boiler camera cleaning, as cleaning access through boiler corner ports will now be unavailable.

All dampers, four (4) each compartment dampers and eight (8) each port (1/3, 2/3) dampers will be actuated and remotely operable from the main control panel. OFA compartment air flow will be sensed at each end of both OFA compartments (front and rear). Indication of compartment air flow and damper position control blocks will be displayed on the main control panel on a videospec screen built specifically for OFA system control. Additionally, differential pressure (flow) instruments will be provided at the throat of each OFA port at local displays. These port flow indicators will be used primarily for side to side, on-line balancing of OFA port flows.

The modifications made to the drum are expected to improve drum level reliability and consistency. Several of the downspouts have been redirected to distribute condensate flow more evenly throughout the drum. Also the drum level sensing taps have been moved approximately 15 feet closer to the outer ends of the drum. These changes should ensure more stability in drum levels indications during transient operation, especially at higher loads.

With the installation of one additional main steam safety valve the new nameplate flow rating on the boiler will be 6.9MMlbs/hr. With this additional valve we are maintaining the redundancy previously existing in the main steam safeties at the new full load steam flow rating of approximately 6.65MMlbs/hr. At this new full load flow rating any one of safety relief valves #4, #5 or #6 can be removed from service without affecting full load capacity. The safety relief valves settings will hereafter be as follows:

| Valve # | Old Set Pressure (psia) | New Set Pressure(psia) |
|---|---|---|
| 1SGG-RV4(new) | NA | 2855 |
| 1SGG-RV5 | 2815 | 2835 |
| 1SGG-RV6 | 2800 | 2815 |
| 1SGG-RV7 | 2785 | 2795 |
| 1SGG-RV8 | 2775 | 2775 |
| 1SGJ-RV1 | 681 | 750 |
| 1SGJ-RV2 | 681 | 750 |
| 1SGJ-RV3 | 692 | 755 |
| 1SGJ-RV4 | 692 | 755 |
| 1SGJ-RV5 | 700 | 760 |
| 1SGJ-RV6 | 700 | 760 |
| 1SGJ-RV7 | 705 | 770 |
| 1SGJ-RV8 | 705 | 770 |
| 1SGJ-RV9 | 630 | 698 |
| 1SGJ-RV10 | 630 | 698 |
| 1SGJ-RV11 | 640 | 720 |
| 1SGJ-RV12 | 640 | 720 |

The actual full load steam flow will be a function of the new HP section efficiency and will be established during the Unit 1 performance testing within the month of April. Unit 2 full load flow was tested at approximately 6.65 MMlbs/hr.

## C. Helper Cooling Tower

***Project Overview***

A helper cooling tower is being installed directly east of the existing cooling towers to augment heat removal requirements at 950MW. The helper tower design allows for a 13% increase in overall cycle heat rejection. This increase will permit the units to run at nominal condenser backpressure throughout the summer months.

The helper tower will operate in a parallel flow path with the existing cooling towers. The new tower will be designed to cool approximately 15% of the total circulating water flow. In support of this flow to the helper tower the circulating water pumps are also being upgraded by approximately 10%.

***Initial Startup Issues***

No startup concerns are anticipated.

***Operational Guidelines***

Operating procedures will be issued prior to releasing the towers to operation in mid-June 2003.

***Drawings***

The attached schematics have been modified to show the new helper tower ties to the existing heat rejection system.

## D. Isophase Bus Cooling

### *Project Overview*

The isolated phase bus duct was originally designed to operate at a maximum of 23,100 amperes at 26 kV or approximately 1040 MVA. This rating provided significant thermal and electrical margin because the generator was originally operated at 880 MVA (840 MW @ >.95 power factor). Even with the generator output increased to 990 MVA (950 MW @ >.96 power factor) the isolated phase bus is still within original design current limits.

However our operating experience with the isolated phase bus at both 840 and 875 MW indicated the bus is operating at higher than design temperatures. The bus was supposed to have been designed so the maximum operating temperature of the enclosure did not exceed 80 C and the temperature of the conductor did not exceed 100 C. We have measured temperatures in excess of 110 C on the generator terminal enclosure and we have had problems with the oxide inhibiting grease on the conductor terminal hardening because of high temperature. Using irreversible temperature strips we have measured temperatures in excess of 160 C on the generator terminals.

In order to resolve concerns about the bus operating temperatures and provide additional thermal and electrical margin we had the bus manufacturer, Delta-Unibus perform an up rate study. Based on the results of the uprate study they are recommended we install a forced cooling system at the generator terminal.

### *Initial Startup Issues*

None expected.

### *Operational Guidelines*

The cooling system is designed to draw air from the building, filter the air and then blow the air from the generator terminal to the generator breaker and from the generator breaker to the transformer. The fan unit will be powered by a 15 HP 3ph 460v motor and will provide 10,000 cfm of total cooling air. The fan unit will be belt driven by one motor and a spare motor will be installed but not connected. If the operating motor fails it will be necessary to install belts on the spare motor.

The cooling system is designed to start automatically when the generator circuit breaker is closed and is also provided with a manual start switch. The control circuit is designed to be fail safe. If any component in the control circuit fails the fan unit will start. If the fan fails to provide adequate airflow an alarm will be sent to the control room Rochester CRT display entitled, "ISOPHASE BUS FAN FAILURE" so the status of the fan unit can be checked.

Should the air handler become inoperable, the temperature indicators mounted on the south side of A phase and the north side of C phase should be monitored to see that these temperatures stabilize below 105°C. Where this does not appear probable, remedial action should be discussed with Eng. Services.

INTERMOUNTAIN POWER SERVICE CORPORATION



## E. Scrubber Forced Oxidation System

### *Project Overview*

A forced oxidation system is currently being installed in the Unit 1 Scrubber Reaction Tanks starting with tanks A, B, E and F. Retrofit of the Unit 2 Reaction Tanks and the remainder of the Unit 1 tanks will be addressed in the near future as equipment availability and material procurement allows.

The scrubber forced oxidation system is designed to provide the additional air needed to increase oxidation of the sulfite ions to sulfate within all operating flue gas desulfurization (FGD) absorber module reaction tanks. The additional air increases the production of the calcium sulfate dehydrate ($CaSO_4 \bullet 2H_20$) byproduct solids.

The forced oxidation system is required primarily because of the increasing sulfur content in current fuel sources. When scrubber sulfur loading increases, the existing equipment is unable to adequately oxygenate the scrubber liquor. This lack of oxygenation allows the sulfur to precipitate in very small crystals called sulfite ($CaSO_3$). The sulfite crystals cause serious problems in dewatering the scrubber effluent but are an even greater concern in causing absorber module scaling. Plugging problems resulting from this scaling in recent months have been a serious concern in both unit scrubbers.

The uprate, although a factor in increased sulfur throughput, is a relatively small factor compared to the increased sulfur percentages within specific fuel sources.

### *Initial Startup Issues*

The forced oxidation systems associated with Unit 1 Scrubber Modules A, B, E and F will be available for manual operation at the end of the current Unit 1 outage. Availability of the Unit 2 system and the remaining Unit 1 modules will depend upon the required schedule for accommodating the higher sulfur fuels.

Currently, U2 Module 1C is scheduled for forced oxidation retrofit to be completed in mid April. A schedule for the remaining modules will be provided soon as approved by Staff.

Due to parts and equipment availability, the forced oxidation system will initially be tied to the discharge of the existing Flyash Air Compressor 1C on each unit. The forced oxidation air piping will temporarily be connected through the abandoned combustion gas reheat return lines to the 1C Flyash Air Compressor. Following receipt and installation of the dedicated, forced oxidation blowers to be located in the north bays of each scrubber building, the 1C Flyash Air Compressor will be returned to normal service.

As a result of forced oxidation system operation, foam generation within the scrubber reaction tanks is anticipated, especially in summer and fall months. Initially, control of this foaming will be the responsibility of Operations. A project priority in the near term is to complete installation of an automated defoamer injection system that, although requiring operator attention, will greatly reduce the burden and increase the controllability of this ongoing problem.

Startup and initial operation of the forced oxidation system will be primarily in manual modes until installation of the remaining field instrumentation and actuators are complete. The system is currently scheduled to be fully operational by the end of April.

Systems required in-service for initial startup of the forced oxidation system include:
- Flyash Air Compressor 1C
- Closed cycle cooling water system for Flyash Air Compressor 1C interstage cooling
- Service water header tie to the specific module humidification system piping
- Correct valve lineup on the new oxidation piping including manual discharge valve (1ASB-BV-735)

The logic for the 1C Flyash Air Compressor has been separated from the flyash system. The 1C Compressor can be directly restored for operation of the flyash system should an emergency condition arise.

A control switch has been temporarily installed inside the flyash control panel to start the 1C Compressor. The switch for the permanent blower will be panel mounted externally at the time of blower installation (ETA 8/15/03). The switch allows for operation of the 1C Compressor either as a forced oxidation blower (left) or as a flyash air compressor (right). All other features of compressor operation including closed cycle cooling valve and unloading valve permits for compressor start, remain unchanged.

Prior to starting 1C Compressor, at least two (2) modules must be valved into the forced oxidation header. See attached P&ID identifying the schematic location of the appropriate valves. After establishing air flow, the 8", module oxidation throttling valves must be adjusted to balance the available flow to all in-service modules. Every effort should be made to maintain humidified air temperatures below 180°F.

*Operational Guidelines*
Systems required for normal startup of the forced oxidation system:

- Availability of at least one of the two 100% oxidation air blowers located at the north end of the scrubber bldgs.. (Confirm isolation of either, out-of-service blower)
- Proper lineup of oxidation air piping valves
- Isolation of the temporary connection to the 1C Flyash Air Compressor
- Proper lineup of humidification water valves, with confirmed flow to the air headers.
- Operation of the defoaming system as needed.

The new oxidation air blowers and system valving will be PLC controlled. Blower inlet vanes, discharge isolation valve, blow-off valve, lube oil pump, oil cooler fan and system actuated valves, will all be automatically placed into service as required, by the programmable controls. Blower inlet vanes will be modulated to control the pressure in the outlet piping.

Each reaction tank has two motor-operated isolation valves, each serving three oxidation air spargers. When the module is in automatic, valves are placed in service based on signal from the module PLC control logic indicating that the module is in service. When the module is in manual, switches on the control panel can be used to open or close the appropriate oxidation air isolation valves. The isolation valves are full open/full close valves that do not modulate.

A manual balancing valve, installed in series with each motor-operated isolation valve, is used to adjust the flow of air to the three air spargers being served. Individual flow transmitters upstream of each isolation valve provide air flow indication to the scrubber control room.

One on/off water isolation valve per reaction tank is provided to allow flow to a header that distributes water to all six humidification stations at each tank. A local humidification water flow indicator is located immediately downstream of the isolation valve. Each of the two branch lines includes a manual valve that can be operated to adjust the water flow rate to the three humidification stations located downstream.

Alarm status will be generated and transmitted to the scrubber control room whenever operator attention is required. System status indications that will be displayed in the scrubber control room include:

- Forced oxidation system pressure low (can be set to auto-start backup blower)
- Oxidation system flow indication at each balancing valve (2 per reaction tank.)
- Blower 1A or 1B operating status
- Reaction tank oxidation air isolation valve status

(Setpoint adjustments for blower discharge pressure controls are located at each blower's local control panel.)

Every effort should be made to maintain humidified air temperatures below 180°F, as shown on the temperature indicators located directly downstream of the humidification stations at each air header (6 per reaction tank). The humidification stations must remain in service whenever oxidation air is flowing to the associated reaction tank. Continuous operation of the humidification station is encouraged unless the respective module and air system are being removed from service for extended periods.

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IGS UPRATE PROJECT COORDINATION
**Agenda**
Date: 9/25/01

1. HP Turbine Retrofit — Phong
   - Mfg. update
   - Valve screen installation
   - #1&#6 stage mods.

2. Generator Uprate — Jon/James
   - Cooling Mods.

3. Isophase Uprate Study — Jerry
   - Breaker upstream mods
   - Breaker downstream mods

4. Boiler Feed Pump Upgrade — Phong
   - 19 day schedule
   - Gary J. scheduled to Q/A and expedite

5. Boiler Mods — James
   - Contract finalization
   - Basic scope/timing
     - Drum mods
     - Pendants
     - Overfire
     - Castings Install
     - Scaffold
     - Safety Relief Mods.
   - NOx limits

6. Cooling Tower Upgrade — Jerry

7. Circ Water Pump Impeller Install Schedule — James

Next coordination meeting to be held on October 30th at 2:00 pm in Conf Rm #4.

IGS UPRATE PROJECT COORDINATION
**Agenda**
Date: 12/12/01

| | |
|---|---|
| 1.Project Economics Overview | James |
| 2. HP Turbine Retrofit | Phong |
| 3. Generator Uprate Study | Jon |
| 4. Isophase Uprate Study | Jon |
| 5. Boiler Feed Pump Upgrade | Phong |
| 6. Primary Superheater Addition | James |
| 7. Cooling Tower Upgrade | Aaron/Jerry |
| 9. Scrubber Wall Ring Contract Update | Dave H./ Jerry |
| 10.HP Heater Drain Line Mods | Dean |

Project leaders to submit revised project estimates and overall project schedule.

Next coordination meeting to be held on January 23rd at 2:00 pm in Conf Rm #4.

IGS UPRATE PROJECT COORDINATION

**Agenda**

Date: 10/31/01

| | |
|---|---|
| 1. Update on Draft/Final Source Plan Review | Rand |
| 2. HP Turbine Retrofit | Phong |
| 3. Generator Uprate Study | Jon |
| 4. Isophase Uprate Study | Jon |
| 5. Boiler Feed Pump Upgrade | Phong |
| 6. Boiler Modifications | James |
| 7. Cooling Tower Upgrade | Aaron/Jerry |
| 9. Scrubber Wall Ring Testing | John |
| 10.HP Heater Drain Line Mods | Dean |

Project leaders to submit revised project estimates and overall project schedule.

Next coordination meeting to be held on November 28th at 2:00 pm in Conf Rm #4.

IGS UPRATE PROJECT COORDINATION
**Agenda**
Date: 9/26/01

| | |
|---|---|
| 1. Update on Preliminary Operating Order | Rand |
| 2. HP Turbine Retrofit | Phong |
| 3. Generator Uprate Study | Jon |
| 4. Isophase Uprate Study | Jon |
| 5. Boiler Feed Pump Upgrade | Phong |
| 6. Boiler Modifications | James |
| 7. Cooling Tower Performance Upgrade | Aaron |
| 9. NOx Reduction Project - Burner Repairs | James |
| 10. Scrubber Wall Ring Testing Results | John |
| 11.HP Heater Drain Line Mods | Dean |

Project leaders to submit revised project estimates and overall project schedule.

Next coordination meeting to be held on October 24th at 2:00 pm in Conf Rm #4.

IP12_003445

IGS UPRATE PROJECT COORDINATION

**Agenda**

Date: 8/29/01

| | |
|---|---|
| 1. Update on NOI developments. | Rand |
| 2. HP Turbine Retrofit | Phong |
| 3. Generator Cooling Enhancements | Jon |
| 4. Isophase Cooling Enhancements | Jon |
| 5. Boiler Feed Pump Upgrade | Phong |
| 6. Boiler Modifications | James |
| 7. Cooling Tower Performance Upgrade | Aaron /Jerry |
| 8. Generator SCW O2 Monitoring (SLMS) (Discuss leaks, rewedge and rewind timing and costs) | Jon |
| 9. NOx Reduction Project | James |
| 10. Scrubber Wall Ring | John H. |
| 11.HP Heater Drain Line Mods | Dean |
| 12.Cooling Tower Makeup Mods | Pam |

Project leaders to submit revised project estimates and overall project schedule.

Next coordination meeting to be held on September 26th at 2:00 pm in Conf Rm #4.

IGS UPRATE PROJECT COORDINATION

**Agenda**

Date: 8/29/01

| | |
|---|---|
| 1. Update on NOI developments. | Rand |
| 2. HP Turbine Retrofit | Phong |
| 3. Generator Cooling Enhancements | Jon |
| 4. Isophase Cooling Enhancements | Jon |
| 5. Boiler Feed Pump Upgrade | Phong |
| 6. Boiler Modifications | James |
| 7. Cooling Tower Performance Upgrade | Aaron /Jerry |
| 8. Generator SCW O2 Monitoring (SLMS)<br>(Discuss leaks, rewedge and rewind timing and costs) | Jon |
| 9. NOx Reduction Project | James |
| 10. Scrubber Wall Ring | John H. |
| 11.HP Heater Drain Line Mods | Dean |
| 12.Cooling Tower Makeup Mods | Pam |

Project leaders to submit revised project estimates and overall project schedule.

Next coordination meeting to be held on September 26th at 2:00 pm in Conf Rm #4.

IGS UPRATE PROJECT COORDINATION

**Agenda**

Date: 6/27/01

Purpose of the Meeting

1) To ensure all projects are progressing toward operation at 950 MWg by 4/2003 (Unit 1) and 4/2004 (Unit 2).

2) Discuss current status of each uprate project including significant budgetary or schedule impacts.

3) Identify significant uprate issues or projects that have arisen during project development.

Identified Projects

| Project | Project Leader(s) |
|---|---|
| -HP Turbine Retrofit | Phong Do/James Nelson |
| -Boiler Safety Valve Addition | Craig Stumph/James Nelson |
| -Boiler Modifications | James Nelson/Craig Stumph |
| -Generator Cooling Enhancements | Jon Christensen/Phong Do |
| -Large Motor Bus Loading Equalization | Pam Bahr |
| -Cooling Tower Performance Upgrade | Aaron Nissen/Jerry Hintze |
| -Isophase Cooling Enhancements | Jon Christensen/James Nelson |
| -Boiler Feed Pump Performance Upgrade | Dave Spence/Phong Do |
| -Main Transformer Cooling | Jon Christensen/James Nelson |
| -NOx Reduction Project | James Nelson |
| -Scrubber Wall Ring | John Howard |
| -Generator SCW O2 Monitoring | Jon Christensen |
| -HP Heater Drain Line Mods | Dean Wood/James Nelson |
| -Cooling Tower Makeup Mods | Pam Bahr/Contract Eng. |
| -Cooling Tower Electrical Redundancy | Pam Bahr/Contract Eng. |
| -PA Fan Motor | Jon Christensen |
| -PAH Sealing Modifications System | Jerry Finlinson |

Project leaders to submit revised project estimates and a detailed project schedule including estimated design, fabrication and installation schedules by the end of the day to James Nelson.

Next coordination meeting to be held on July 25th at 2:00 pm in Conf Rm #4.

IGS UPRATE PROJECT COORDINATION

**Agenda**

Date: 5/23/01

Purpose of the Meeting

1) To ensure all projects are progressing toward operation at 950 MWg by 4/2003 (Unit 1) and 4/2004 (Unit 2).
2) Discuss current status of each uprate project including significant budgetary or schedule impacts.
3) Identify any new issues or projects that may require attention within the uprate window.

Identified Projects

| Project | Project Leader(s) |
| --- | --- |
| -HP Turbine Retrofit | Phong Do/James Nelson |
| -Boiler Safety Valve Addition | Dean Wood/Craig Stumph |
| -Generator Cooling Enhancements | Phong Do/Jon Christensen |
| -Large Motor Bus Loading Equalization | Pam Bahr |
| -Cooling Tower Performance Upgrade | Aaron Nissen |
| -Isophase Cooling Enhancements | Jon Christensen |
| -Boiler Feed Pump Performance Upgrade | Dave Spence |
| -Main Transformer Cooling | Jon Christensen |
| -NOx Reduction Project | Jerry Hintze/James Nelson |
| -Scrubber Wall Ring | John Howard |
| -Generator SCW O2 Monitoring | Jon Christensen |
| -HP Heater Drain Line Mods | Dean Wood |
| -Boiler Modifications | Craig Stumph/James Nelson |
| -Cooling Tower Makeup Mods | Pam Bahr |
| -Cooling Tower Electrical Redundancy | Pam Bahr |
| -PA Fan Motor | Jon Christensen |
| -PAH Sealing Modifications System | Jerry Finlinson |

Project leaders to submit revised project estimates and a detailed project schedule including estimated design, fabrication and installation schedules by the end of the day to James Nelson.

Next coordination meeting to be held on June 27th at 2:00 pm in Conf Rm #3.

IGS UPRATE PROJECT COORDINATION
**Kickoff Meeting Agenda**
Date: 4/11/01

Purpose of the Meeting

1) To ensure all projects are identified to allow for operation at 950 MWg by 4/2003 (Unit 1) and 4/2004 (Unit 2).
2) Assign a project leader to each project and discuss the general scope of each project.
3) Discuss the schedule impacts associated with each project identified.

Assignment of Identified Projects

| Project | Project Leader(s) |
|---|---|
| -HP Turbine Retrofit | Phong Do/James Nelson |
| -Boiler Safety Valve Addition | Dean Wood/Craig Stumph |
| -Generator Cooling Enhancements | Phong Do/Jon Christensen |
| -Large Motor Bus Loading Equalization | Pam Bahr |
| -Cooling Tower Performance Upgrade | Aaron Nissen |
| -Isophase Cooling Enhancements | Jon Christensen |
| -Boiler Feed Pump Performance Upgrade | Dave Spence |
| -Main Transformer Cooling | Jon Christensen |
| -NOx Reduction Project | Jerry Hintze/James Nelson |
| -Scrubber Wall Ring | John Howard |
| -Generator SCW O2 Monitoring | Jon Christensen |
| -HP Heater Drain Line Mods | Dean Wood |
| -Boiler Modifications | Craig Stumph/James Nelson |
| -Cooling Tower Makeup Mods | Pam Bahr |
| -Cooling Tower Electrical Redundancy | Pam Bahr |
| -PA Fan Motor | Jon Christensen |

Uprate Coordination Committee meetings will be scheduled on the fourth Wednesday of each month at 2:00 pm in Conf Rm #3. Project leader(s) hold the responsibility, together, to coordinate the various aspects of the project, ensure required progress, involve all interested departments and groups in design and to provide accurate updates to the Uprate Coordination Committee on a monthly basis.

Minimum Project Requirements for May Meeting

Project leaders to submit revised project estimates and a detailed project schedule including estimated design, fabrication and installation schedules. Where exact design requirements are impossible to foresee, a worst expected schedule shall be provided after consultation with the applicable vendors.

Next coordination meeting to be held on May 23rd at 2:00 pm in Conf Rm #3.

# Unit 2 Uprate Major Project Update

1. Unit 2 Combustion System Replacement:
The Unit 2 burner and scanner systems were successfully replaced during the spring outage ending March 28, 2004. The previous B&W burners were replaced with current technology burners manufactured by Advanced Burner Technology (ABT). The previous Bailey UV scanning system was replaced with a current technology, visible light spectrum ABB fiberoptic system. Contract specifications included complete combustion air modeling and supply of resulting air flow baffles/turning vanes. The air side balancing was installed during the outage and appears initially to be successfully balancing the combustion air delivery to each burner. Initial monitoring of combustion profiles confirms that the burners and scanner systems are operating well. No Initial adjustments were required for burner stability. Scanner systems required only minor adjustment. Complete optimization of combustion side components will occur within the upcoming four weeks as on-line, fuel side balancing is completed.

2. Secondary Air Heater Modifications:
During the Unit 2 Outage the first set of secondary air heater modifications were completed. Unit 1 modifications are scheduled to follow next year. The modifications included a complete re-design of the old, 4-level rotor to an enhanced 2-level system. This new design, sold under the name 'Clearflow', allows for higher heat transfer efficiencies, lower pressure drop, and more effective/reduced cleaning. Initial performance data indicates that both heat transfer and pressure drop are significantly improved. Full contract performance testing will be completed within the next 60 days.

3. Overfire Air and Superheat Modifications:
Installation of the new overfire air system (OFA) and platen superheat modifications were completed on Unit 2 as was done on Unit 1 last year. This system included several design improvements from the base Unit 1 system as originally designed by BPI. The operating permit from Utah Division of Air Quality has, as yet, not been received. As a result, this system has not been operationally tested nor placed in service. The design improvements include more favorable orientation of the OFA system ports to provide enhanced air distribution, external linkage access for on-line adjustment and platen superheater surface adjustments to match heating characteristics of the Unit 2 Boiler. This system will be operationally tested as soon as permits are received.

4. DCS Information Systems Replacement(Phase I):
The first of two phases in the Unit 2 DCS Replacement project is now complete. This first phase includes the Data Acquisition Systems, Plant Information System Interfaces, Sequence of Events System, Annunciation System and associated system communication inter-ties with existing control segments. Many of the old displays have been replaced as a part of this first phase. Unit 1 information systems will be replaced next year. The final two outages in 2006 & 07 will complete the DCS system replacement as the control systems are replaced in each unit. The first phase on Unit 2 was completed on schedule and without significant startup schedule impacts.

5. Induced Draft Fan Drive Cabinet Replacement:

The Unit 2 'D' Induced Draft Fan LCI Variable Speed Drive Cabinet was replaced with a current version of the LCI (load commutator inverted) technology by Alstom, Inc. The drives include a fully digital control interface allowing greater diagnostic and control reliability. These drives were replaced based on obsolescence and availability of parts. The drives are now internally cooled with chilled water exchangers and are designed with far higher component temperature tolerance. The current schedule includes changeout of the remaining drive cabinets on Units 1 & 2 over the next four years.